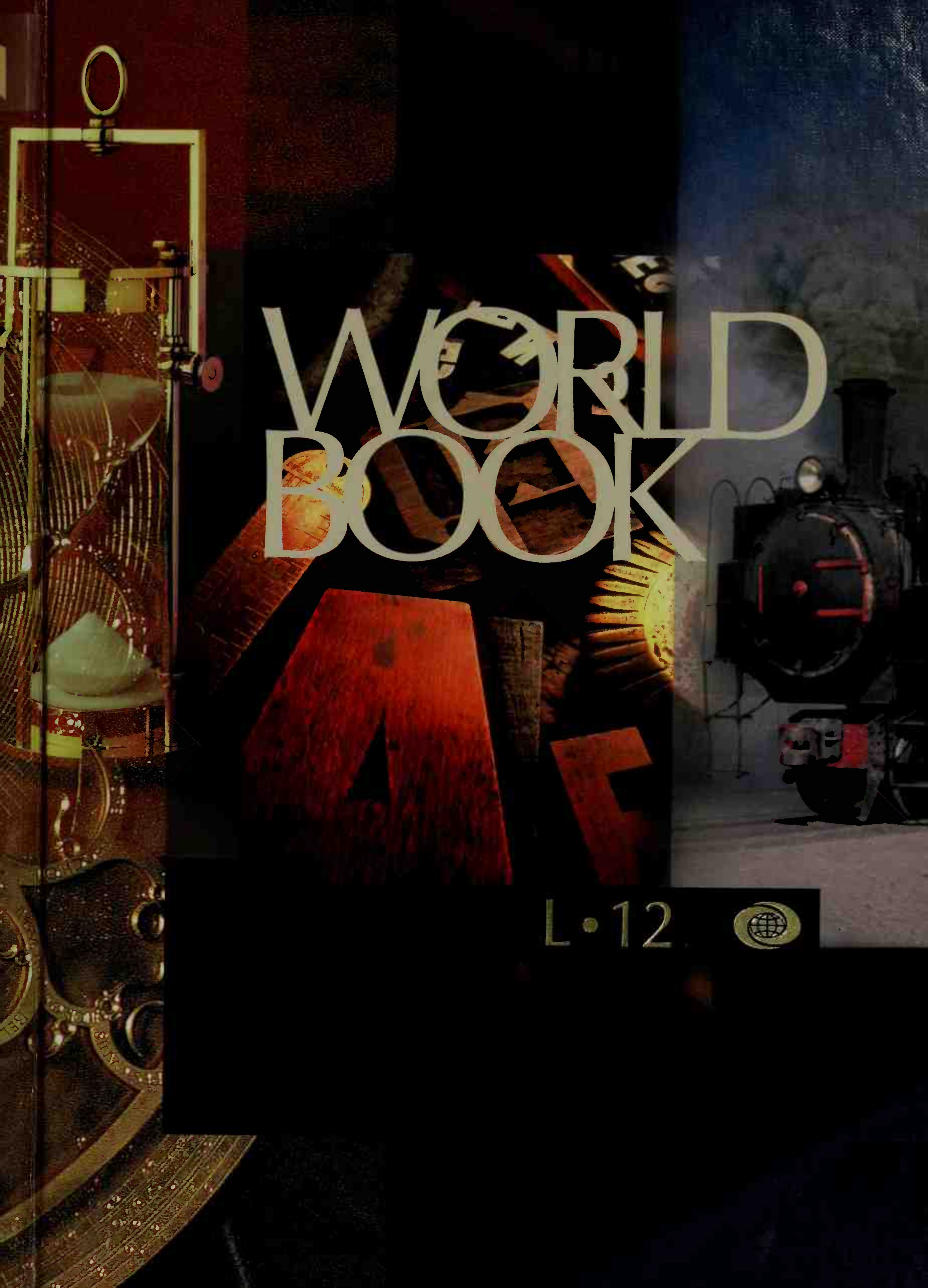
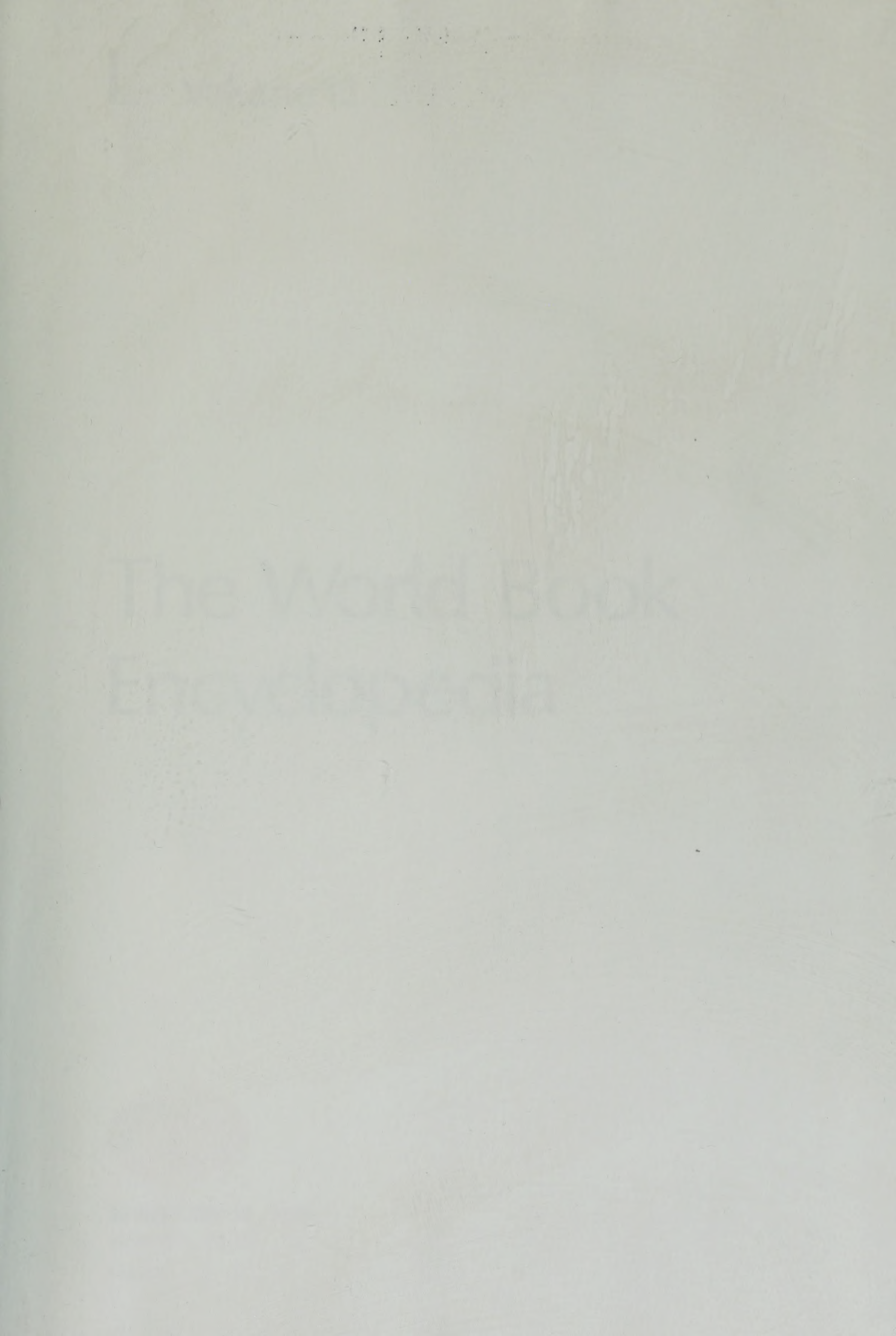
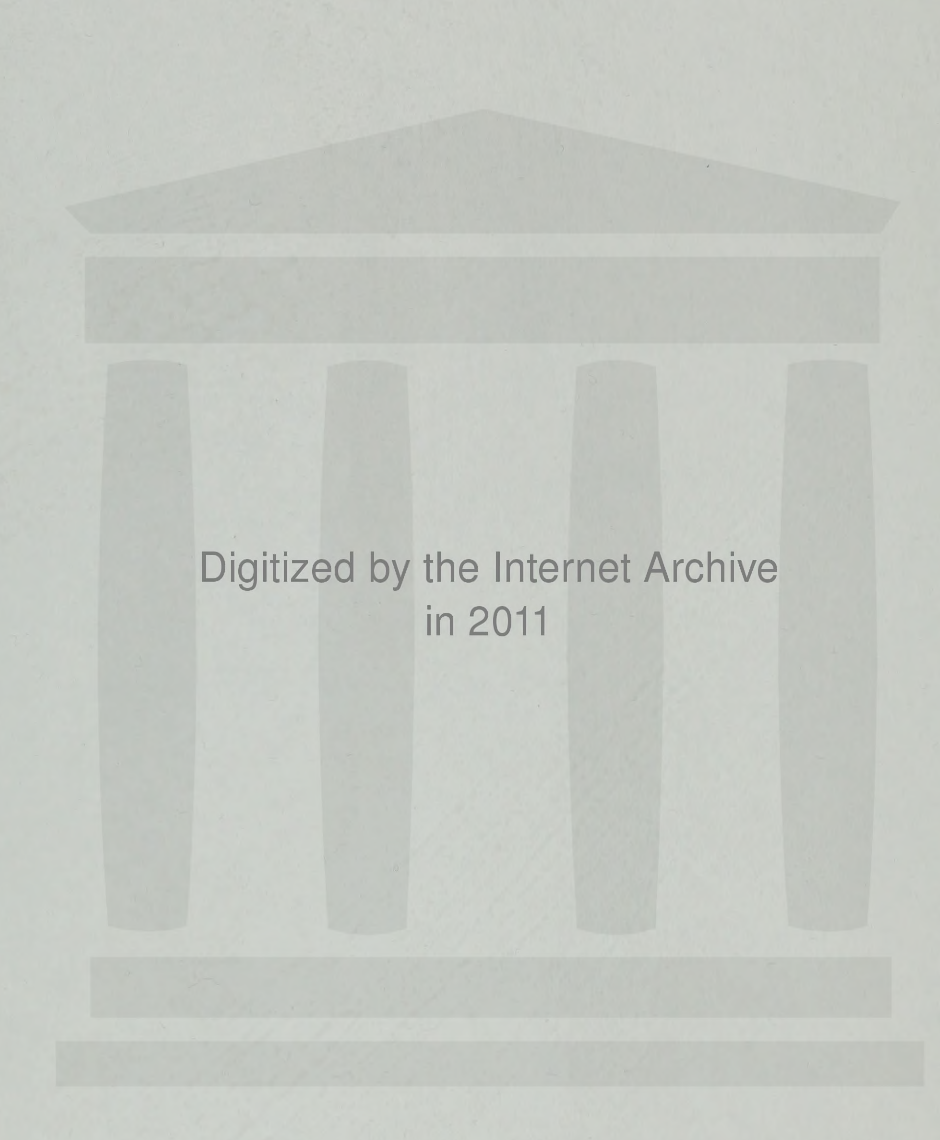

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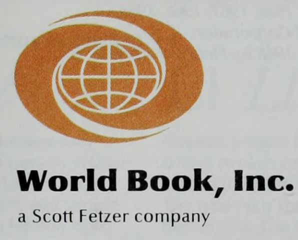


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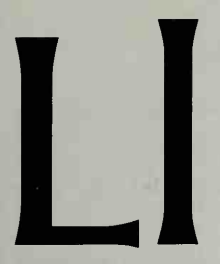
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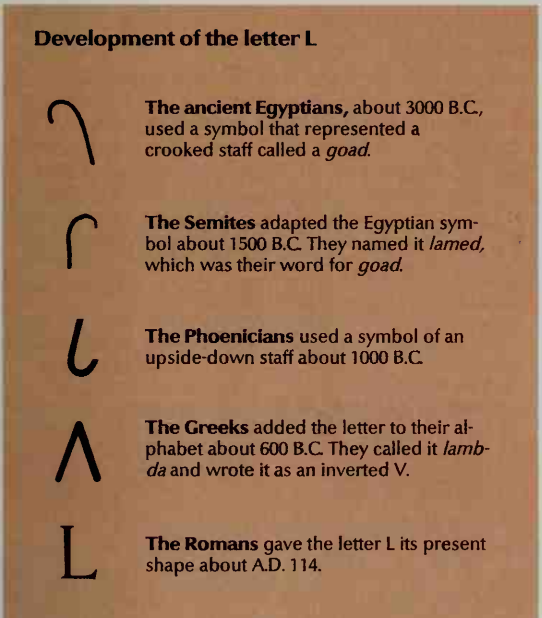
L is the 12th letter of our alphabet. It was also a letter in the alphabet used by the Semites, who once lived in Syria and Palestine. They named it *lamed,* their word for *goad,* or *crooked staff.* They adapted an Egyptian *hieroglyphic* (picture symbol) meaning *goad* to represent the letter. The ancient Greeks took the letter into their alphabet and called it *lambda.* Later, the Romans borrowed it from the Greek alphabet and gave the letter its present capital L form. See **Alphabet.**

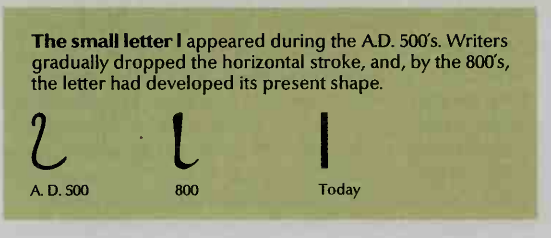
Uses. *L* or *l* is the 11th most frequently used letter in books, newspapers, and other printed material in English. *L* is the Roman numeral for *50.* When it is written with the crossbar, as £, it is the sign for pound in English money, and comes from the Latin word *libra,* or *pound.*

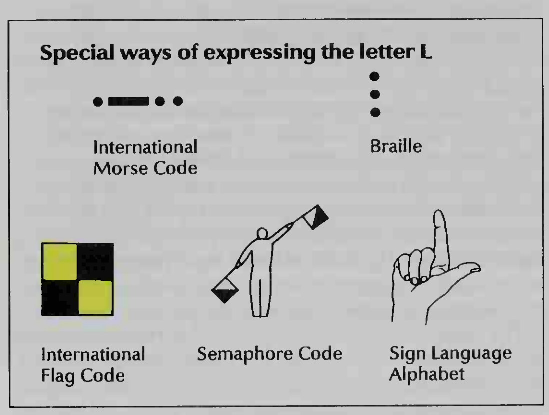
In physics, *L* stands for *length,* as it does in most measurement formulas. In geography, *L* indicates *longitude,* and *l* stands for *latitude.* The *l* also stands for *leaf* in describing books, and for *left* as in *l.f.,* or *left field;* and for *lower* as in *l.c.,* or *lower case,* a term used in typography and journalism.

Pronunciation. In English, *l* is pronounced by placing the tongue on the edge of the lower front teeth and with its sides free. The velum, or soft palate, is closed, and the vocal cords are vibrated with the breath.

L is silent in words such as *would, salmon,* or *half.* In Mexican and other American Spanish dialects, *ll* is pronounced as *y* is pronounced in English. See **Pronunciation.** Marianne Cooley







Common forms of the letter L

Ll *Ll*

Handwritten letters vary from person to person. *Manuscript* (printed) letters have straight lines, *left,* and simple curves. Cursive letters, *right,* have flowing lines.

Ll *Ll*

Roman letters have small finishing strokes called *serifs* that extend from the main strokes. The type face shown above is Baskerville. The italic form appears at the right.

Ll *Ll*

Sans-serif letters are also called *gothic letters.* They have no serifs. The type face shown above is called Futura. The italic form of Futura appears at the right.

L

Computer letters have special shapes. Computers can "read" these letters either optically or by means of the magnetic ink with which the letters may be printed.

La Raza, National Council of. See National Council of La Raza.
Laayoune. See El Aaiun.
Labor, in birth. See Childbirth.
Labor, in economics. See Labor movement.
Labor, Department of, is an executive department of the United States government that works to promote the welfare of wage earners. The department seeks to improve the economic position of workers in the United States, to better their working conditions, and to advance their opportunities for employment.



The seal of the Department of Labor

The secretary of labor, a member of the president's Cabinet, heads the department. The president appoints the secretary subject to the approval of the U.S. Senate.

Functions. The Department of Labor administers federal laws on minimum wages, overtime, child labor, and migrant workers and determines wage rates for work done under government contracts. A Labor Department agency called the Occupational Safety and Health Administration (OSHA) develops and enforces job safety and health standards for most U.S. industries.

The Labor Department administers federal laws on workers' compensation programs and enforces legal standards for the funding and operation of private pension and welfare plans. It also oversees the nation's unemployment insurance programs.

The department works to reduce unemployment by providing job training for disadvantaged young men and women. The department helps people find jobs through programs administered by one of its agencies, the U.S. Employment Service. The department also gives local governments funds to establish and maintain their own job training programs for disadvantaged and unemployed people. In addition, it develops apprenticeship standards for the training of skilled workers.

The Labor Department enforces federal regulations that require businesses doing work for the U.S. government to maintain nondiscriminatory hiring and employment practices. These regulations are designed to guarantee equal employment opportunity to ethnic minorities, women, disabled people, and veterans.

The department administers laws that require the fair election of labor leaders and the publication of accurate union financial reports. In addition, it promotes cooperation between labor unions and employers.

Another important Labor Department function is that of serving as the U.S. government's chief fact-finding agency in the field of labor economics. The department's Bureau of Labor Statistics collects, analyzes, and publishes information on employment and unemployment, wages and industrial relations, occupational safety and health, and productivity and technology. The bureau prepares the Consumer Price Index (CPI), the most widely used measurement of price trends in the United States.

Secretaries of labor

Name	Took office	Under President
William B. Wilson	1913	Wilson
James J. Davis	1921	Harding, Coolidge, Hoover
William N. Doak	1930	Hoover
*Frances Perkins	1933	F. D. Roosevelt, Truman
Lewis B. Schwellenbach	1945	Truman
Maurice J. Tobin	1948	Truman
Martin P. Durkin	1953	Eisenhower
James P. Mitchell	1953	Eisenhower
*Arthur J. Goldberg	1961	Kennedy
W. Willard Wirtz	1962	Kennedy, L. B. Johnson
*George P. Shultz	1969	Nixon
James D. Hodgson	1970	Nixon
Peter J. Brennan	1973	Nixon, Ford
John T. Dunlop	1975	Ford
W. J. Usery, Jr.	1976	Ford
Ray Marshall	1977	Carter
Raymond J. Donovan	1981	Reagan
William E. Brock III	1985	Reagan
Ann Dore McLaughlin	1987	Reagan
*Elizabeth H. Dole	1989	G. H. W. Bush
Lynn Martin	1991	G. H. W. Bush
Robert B. Reich	1993	Clinton
Alexis M. Herman	1997	Clinton
Elaine L. Chao	2001	G. W. Bush

*Has a separate biography in *World Book.*

History. In 1884, Congress established a Bureau of Labor in the Department of the Interior. In 1888, Congress gave the bureau independent status as the Department of Labor. In 1903, Congress established the new Department of Commerce and Labor and made the Department of Labor a bureau in it.

In 1913, President Woodrow Wilson signed a law creating an independent Department of Labor. The office of secretary of labor became the first Cabinet-level office to be occupied by a woman when Frances Perkins was appointed to the post in 1933.

Critically reviewed by the Department of Labor

Related articles in World Book include:

Apprenticeship and Training, Bureau of
Consumer Price Index
Employment Service, United States
Fair Labor Standards Act
Flag (picture: Flags of the United States government)
Job Corps
Labor Statistics, Bureau of
Occupational Safety and Health Administration
Unemployment insurance
Wages and hours
Women's Bureau

Labor, Knights of. See Knights of Labor.
Labor Day is a holiday honoring working people. It is observed as a legal holiday on the first Monday in September throughout the United States, Puerto Rico, and Canada. Labor organizations sponsor various celebrations, but for most people it is a day of rest and recreation. The holiday also has become a symbol of the end of summer. In Australia, Labor Day is called *Eight Hour Day,* and it commemorates the successful struggle for a shorter working day. In Europe, Labor Day is observed on May 1.

Two men have been credited with suggesting a holiday to honor working people in the United States—Matthew Maguire, a machinist from Paterson, New Jersey, and Peter J. McGuire, a New York City carpenter who helped found the United Brotherhood of Carpenters

and Joiners. Both men played an important part in staging the first Labor Day parade in New York City in September 1882. In 1887, Oregon became the first state to make Labor Day a legal holiday. President Grover Cleveland signed a bill in 1894 making Labor Day a national holiday. Jack Santino

Labor force is the segment of a nation's population that works for pay or is actively seeking work. This group produces most of the nation's goods and services, and its size and productivity help determine the nation's economic growth. The United States labor force expanded from about 2 million in 1800 to over 130 million in 2000. During this period, it changed from a mainly agricultural one to one composed mainly of industrial, service, and white-collar workers.

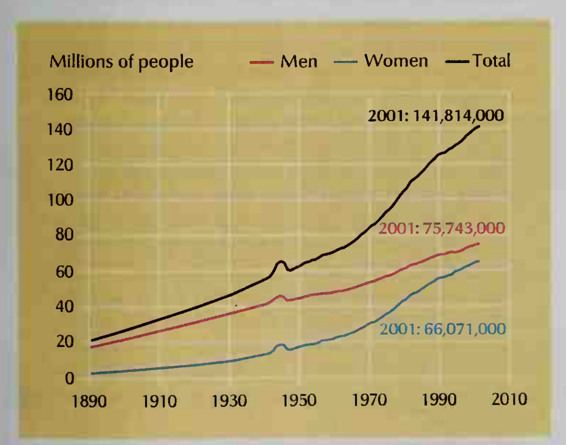
The United States government uses the term *labor force* for people at least 16 years old who have civilian jobs or are actively looking for jobs, or who are in the armed forces. Groups not in the labor force include disabled persons, full-time homemakers, retired people, and students. The labor force also does not include discouraged job seekers who have stopped looking for work because they think none is available.

Occupation groups in the United States

Occupation groups	Number of employed people*
White-collar workers	**80,938,000**
Clerical	18,503,000
Professional and technical	26,053,000
Sales	16,044,000
Managers	20,338,000
Blue-collar workers	**32,531,000**
Operatives	17,698,000
Craftworkers	14,833,000
Service workers	**18,359,000**
Other than private household	17,644,000
Private household	715,000
Farm, forestry, and fishing workers	**3,245,000**
Farmers and farm managers	1,108,000
Other farm, forestry, and fishing workers	2,136,000
Total workers	**135,073,000**

*Figures for individual categories may not add up to totals due to rounding. Figures are for 2001.
Source: U.S. Bureau of Labor Statistics.

Men and women in the United States labor force*



*1890-1946, persons 14 years old and over; since 1947, persons 16 years old and over. Data prior to 1994 include members of the armed forces.
Source: U.S. Bureau of Labor Statistics.

The United Nations (UN) uses the term *economically active population* instead of *labor force.* The economically active population consists of people of all ages who are employed or looking for jobs. The percentages of teen-agers and old people in this group are higher in many developing countries than in industrial nations.

Economists sometimes use the term *human resources* for the total number of people available to work if needed. During a war, for example, many people not normally in the labor force take jobs in war plants.

Changes in the labor force since 1900 include differences in sex, age, and occupational makeup. In 1900, the labor force included only about 20 percent of American women, compared with 47 percent in 2000. Much of the increase was among married women working outside the home. A large number of women joined the labor force because of changing social attitudes, rising divorce rates, declining birth rates, and higher wages. Another cause of increased female employment was an increase in the number of *white-collar jobs.* White-collar jobs include business, clerical, and professional positions, which many women choose. The increasing availability of labor-saving household appliances since about 1950 has also contributed to the large participation of married women in the labor force.

During the same period, the percentage of men 65 and older who were in the labor force fell from about 65 percent to about 15 percent. A major cause of this decline in the number of older men in the work force was the introduction of social security, which enabled many older men to retire. Compulsory retirement rules, plus job discrimination against the elderly, also pushed older men out of the labor force.

In 1900, white-collar workers made up about 20 percent of the labor force, compared with nearly 60 percent in 2000. The percentage of farmworkers dropped from about 40 percent to less than 3 percent during the same period. These changes resulted largely from increased technology, which boosted the demand for white-collar employees and reduced the need for agricultural workers.

The government and the labor force. The U.S. government, through the Department of Labor, has various agencies and programs that promote employment of the labor force. For example, an agency called the United States Employment Service matches job seekers with available positions. The Job Corps program promotes employment by providing work training for disadvantaged youths.

The main job program of the U.S. government is a revenue-sharing plan authorized by the Job Training Partnership Act of 1982. Under this law, state and local governments receive federal funds to provide job training for unskilled, needy youths and for needy adults. Private firms supply this training. Paul L. Burgess

See also Careers (graph: Average starting salaries in the U.S.); Unemployment.

Labor legislation. See Labor movement.

Labor-management relations. See Industrial relations.

Labor-Management Reporting and Disclosure Act. See Labor movement (Charges of corruption).

Labor movement is a term that refers to the efforts of workers as a group to improve their economic position. The movement consists chiefly of attempts by labor unions to promote the welfare of wage earners. But political parties and other groups have also played a part in the labor movement.

Before the development of labor unions, individual laborers had almost no voice in determining their wages, hours, or working conditions. There was a plentiful supply of labor, and employers could easily replace any worker who threatened to quit. The competition for jobs forced poor people to work under almost any conditions.

Workers formed unions because their bargaining power as a group was greater than that of individuals. If all the employees in a factory or other business stopped work, it would be difficult to replace them. But early unions faced strong opposition. Courts regarded the first attempts at group bargaining as illegal, and employers refused to recognize unions as the representatives of workers.

In the United States, the labor movement began to be more widely accepted during the 1930's. The National Labor Relations Act of 1935 and other laws required employers to bargain with unions. By 1945, more than a third of all nonagricultural laborers were union members. Today, organized labor is still a powerful economic force, even though the percentage of workers who belong to a union has declined sharply. The highest percentage of union members are in construction, manufacturing, mining, and transportation industries.

The labor movement, along with economic progress, has given workers a higher standard of living. Compared to past laborers, modern workers earn higher wages, work shorter hours, are better protected against accidents, and receive more fringe benefits. However, some people believe that unions are too large and too powerful.

In the United States and Canada, union goals and activities are much alike. The labor movement in most other countries differs greatly from that in these two nations. Most of the sections of this article deal with the labor movement in the United States.

What labor unions do

The chief aims of a labor union are to improve the wages, hours, working conditions, and job security of its members. Usually, the first step for any union is to get workers to join it. After a union has become established in a plant or industry, its major functions are arranging labor contracts and handling job disputes. Some labor groups help provide apprenticeship programs and other benefits for their members. Unions are also concerned with political activities and public relations.

Organizing workers is the process of bringing wage earners together into a union. In some cases, the workers themselves form a union to increase their bargaining power. In other cases, an existing union decides to organize the employees of a particular plant or industry. The union sends men and women called *organizers* to persuade workers to join.

Most unions insist on being the sole representative of a particular group of employees. They do not want to share the privilege of representing the workers with any other group. This practice is called the *principle of exclusive jurisdiction.* The National Labor Relations Board conducts secret-ballot elections at firms to determine which union workers want, if any.

A union tries to get all the workers in a plant or industry to join the union. In some establishments, the union and the employer agree to set up a *union shop.* In a union shop, the employer can hire anyone. But new employees must join the union within a certain period or pay the equivalent of union dues. This arrangement spreads the cost of union representation evenly among the employees, who also share any benefits the union wins. But individuals who oppose the union must contribute to it against their wishes. Twenty-one states, most of them in the South, have laws banning union shops. Such laws are called *right-to-work laws* because they guarantee a person's right to obtain employment without joining or supporting a union.

A business that employs both union and nonunion workers is called an *open shop.* Union dues are higher in most open shops than in union shops because fewer people share the cost of union representation. In a *closed shop,* which is now generally illegal, the employer could hire only union members.

During the 1800's and early 1900's, many employers insisted that their workers sign a promise not to join a union. Such an agreement was called a *yellow-dog contract.* The Norris-La Guardia Act of 1932 said that an employee could not be sued in federal court for breaking a yellow-dog contract. As a result, such agreements became unenforceable and gradually disappeared.

Arranging contracts. Labor's goals are often different from those of management. Higher wages and benefits increase costs, and management usually wants to reduce costs in order to earn a larger profit. The two sides settle their differences and establish conditions that are acceptable to both through a process called *collective bargaining.*

In a typical bargaining session, union representatives make demands and management then makes a counteroffer that meets some, but not all, of the union's demands. The two sides then try to work out a compromise. The bargainers may call in outside experts to help, including lawyers, economists, and industrial engineers. Many meetings also include state or federal government representatives to help settle disagreements. The results of the bargaining go into a written contract.

Usually, contract talks begin several months before the existing agreement comes to an end. Some unions have a *no contract-no work* rule and stop work if their contract expires before a new one is signed.

A labor contract describes in detail the arrangements concerning wages, hours, and other terms of employment. Some of the most important matters covered are (1) union security, (2) wages and hours, (3) fringe benefits, (4) seniority, (5) safety measures, and (6) the handling of grievances.

Union security is a term for the part of a labor contract that provides for the position and rights of the

Daniel Quinn Mills, the contributor of this article, is Professor of Business Administration, Harvard University.



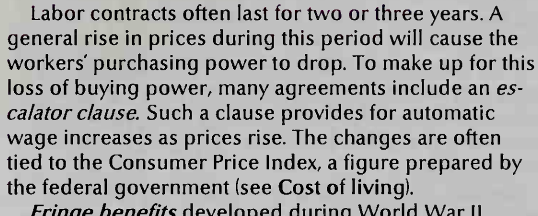
At the bargaining table, representatives of management and labor meet to establish conditions of employment that are acceptable to both sides. This process is called *collective bargaining.*

John Collier, Detroit *Free Press*

union. Most agreements begin by stating that management recognizes the union as sole bargaining agent for a specific group of employees. In some cases, the employer agrees to deduct union dues from the pay of members. This arrangement, called a *checkoff,* is easier for the union than collecting from individual members. Most contracts also include rules about whether union officials can meet with employees during working hours. Other provisions cover whether the plant is a union or open shop and what kinds of union business can be conducted on company time.

Wages and hours. Nearly all labor contracts specify wage rates either by the hour or by the number of goods produced. Some agreements also guarantee employees a minimum number of hours of work.

Contracts also cover overtime pay. Federal law requires that firms engaged in interstate commerce pay overtime for any work that exceeds 40 hours per week. The overtime rate must be at least one and a half times the usual pay. In a contract, the overtime rate is often twice the normal rate. Some companies pay overtime for work over 30 or 35 hours a week.



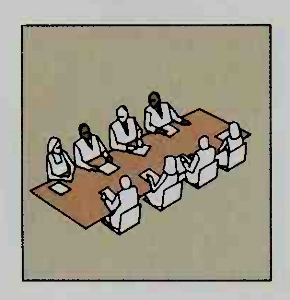
Labor contracts often last for two or three years. A general rise in prices during this period will cause the workers' purchasing power to drop. To make up for this loss of buying power, many agreements include an *escalator clause.* Such a clause provides for automatic wage increases as prices rise. The changes are often tied to the Consumer Price Index, a figure prepared by the federal government (see **Cost of living**).

Fringe benefits developed during World War II (1939-1945), when the federal government prohibited nearly all wage increases. War industries attracted workers by offering benefits in addition to wages. For example, employers paid part of the cost of food served in their cafeterias. Later, companies furnished pensions, medical insurance, life insurance, accident and disability insurance, and college tuition for workers and their families.

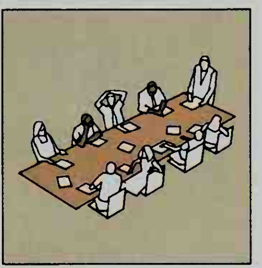
Since then, fringe benefits have grown in importance. Some employers have introduced new benefits, including free dental care and company stock purchase plans. Unions often accept fringe benefits instead of higher pay because most benefits are not subject to income tax.

The settlement of labor disputes

These drawings show some of the steps that labor and management take as they attempt to settle disputes over wages, hours, and other issues.



Union bargainers make demands, and management makes an offer that meets some of the demands.



If the two sides cannot agree, they call in a neutral third party called a *mediator* to suggest solutions.



WORLD BOOK illustrations by David Cunningham

If mediation fails, a specialist called an *arbitrator* hears the case and delivers a decision that is binding on both sides.

Seniority refers to employees' rights based on length of service. This provision is one of the most important parts of a contract. Detailed rules specify how seniority is acquired. It may be based on how long a worker has served in a particular job, department, or plant. If the company must lay off any workers, it first dismisses employees with the least seniority.

Safety measures. Some labor contracts include minimum safety standards for factories and other workplaces. The rules deal with fire prevention, protective clothing and railings, and other safety matters.

The handling of grievances. Most labor agreements specify a series of steps that can be used to handle a worker *grievance* (complaint). An employee with a grievance discusses the matter with his or her supervisor. In most cases, a union representative accompanies the worker. Nearly all problems end at this level. If the matter is not resolved, the worker may file a complaint with a higher level of management. If the employee is still not satisfied, a neutral third party may be called on to deliver a decision.

Handling labor disputes. Most disputes between unions and management involve wages, hours, or other conditions of employment. If labor and management cannot settle their differences and produce a new contract, they may receive outside help called *mediation.* If the two sides still cannot agree, and the existing contract expires, the union may call a strike to press its demands. If a contract is in place, the union and management may submit the union's grievances to a process called *arbitration.* A person called an arbitrator hears the evidence and hands down a decision that is binding on both sides.

Unions—or the workers themselves, against union advice—may use several methods other than a strike to press their demands. For example, they may *slowdown* —that is, deliberately reduce the rate of production. A union may refuse to deal with a firm and urge the public not to buy its products. This action is called a *boycott.* Large numbers of workers may call in sick. Government employees sometimes use this tactic in states where the law forbids them to strike. For example, police officers may threaten an outbreak of "blue flu" to protest job conditions.

Mediation and arbitration. In mediation, a neutral third party called a *mediator* suggests solutions to the dispute. Neither side is required to accept the recommendations, however. Sometimes, labor and management ask for help from a local citizen whom both sides respect and trust. However, most disputes that require mediation go to a government agency called the Federal Mediation and Conciliation Service or to a similar state agency. If mediation fails, the two sides may enter into binding arbitration (see **Arbitration**).



WORLD BOOK photo by Bob Frerck

A picket line patrols the entrance of a factory, office, or store where workers are on strike. A strike or the threat of a strike is a main bargaining weapon of organized labor.

A special agency called the National Mediation Board settles disputes in the railway and airline industries. Congress established the agency in 1934, when railway unions were strong and railroad strikes could cripple the economy. The board later received authority to deal with airline disputes as well.

The National Labor Relations Board also helps settle some labor disputes. If an individual, employer, or union files charges of unfair labor practices, the board investigates and corrects the situation if necessary.

Strikes occur when workers feel such action is the best way to pressure their employer into granting their demands. Before a union calls a strike, it must put the question to a vote by its members. In most unions, a

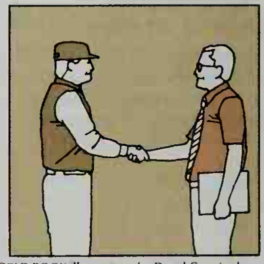
The handling of grievances

Most labor contracts specify a series of steps that can be used to handle a worker *grievance* (complaint). These drawings show one common grievance procedure.

An employee with a grievance explains the problem to the union representative in his or her department.



Together, the worker and the union representative discuss the matter with the employee's supervisor.



WORLD BOOK illustrations by David Cunningham

Nearly all problems end at this stage. A worker who is not satisfied may appeal to a higher level of management.

strike cannot be called unless a majority of those voting support such action.

There are several kinds of strikes. In the most common type, the employees as a group leave work or refuse to come to work. The union organizes small groups of strikers, called *pickets,* to patrol the entrances to the factory, office, or store. The pickets form a *picket line* and carry signs announcing the strike. Members of nonstriking unions usually refuse to cross a picket line. The pickets try to prevent other employees from working and the public from doing business with the company. Strikers call individuals who work during a strike *scabs* or *blacklegs.*

Another type of dispute is a *sit-down strike,* in which the strikers stop work but continue to occupy the facilities. Their action prevents management from bringing in replacements called *strikebreakers.* A *sympathy strike* is a work stoppage by employees not directly involved in a dispute. They strike to show support of another group. A similar action is a *secondary boycott,* in which nonstriking workers refuse to handle goods produced by a company whose employees are on strike. A work stoppage by all laborers in a community, region, or country is called a *general strike.* A *wildcat strike* is started by workers or by local union officials without national union authorization. Such actions are also called *outlaw strikes* or *quickie strikes.* A *jurisdictional strike* is a struggle between two unions for the right to represent a group of workers or to handle a job.

Many strikes succeed during periods of low unemployment and prosperous economic conditions. During periods of high unemployment and less prosperity, more strikes fail. Workers can no longer afford the loss of income, and they may return to work without winning any of their demands. Many unions maintain a strike fund to provide small payments to striking members.

Lockouts are management's own version of a strike. In a lockout, the company refuses to let employees work until they accept its terms.



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Union members meet in committee on a regular basis to conduct local union business. They also discuss such labor issues as wages, hours, working conditions, and job security.

Conducting apprenticeship programs. Apprenticeship is a formal system of training young people for skilled trades, such as bricklaying and printing. Unions in these trades conduct apprenticeship programs in cooperation with employers and vocational high schools. The training combines on-the-job experience with individual or classroom instruction.

Other union activities. Some unions provide facilities called *hiring halls* where members seek job openings. Such hiring is common in the building trades, shipping, and other industries where workers are employed by the day or week.

A number of labor organizations operate vacation resorts or other recreational centers for members and their families at low cost. Some groups have credit unions, which lend money at low interest rates to members. A few labor unions form purchasing cooperatives to buy goods in large quantities at low prices.

Many labor organizations provide educational programs dealing with economics, the history of the labor movement, or other subjects. A number of groups offer college scholarships for union members and their children.

Labor unions use education and advertising to convince people of the importance of their goals. Many organizations employ public relations experts to help win favorable public opinion. Unions also do community service. For example, they may conduct blood donation or fund-raising drives.

Political activities are also an important part of the labor movement. Union officials urge workers and their families to vote for candidates who are sympathetic to union goals. Because of the ability of union leaders to influence votes, most elected officials listen carefully to what labor leaders want. In this way, organized labor influences the city, state, and federal government.

Types of unions

Labor unions can be divided into two chief types: (1) craft unions and (2) industrial unions. A craft union is made up of skilled workers in a particular craft or trade, such as carpentry or plumbing. The members of the union may work in many different industries. An industrial union is made up of both skilled and unskilled workers in the same industry, such as the automobile or steel industry. When a craft union bargains with an employer, it speaks for only part of the firm's workers—for example, the electricians or the bricklayers. When an industrial union bargains, it speaks for all the production and maintenance workers in the company except management personnel.

The members of craft unions tend to be better educated and more highly trained than members of industrial unions. Most craft unions are unified because the members share common training and interests.

Industrial unions tend to have larger memberships than craft unions. Most also have greater bargaining power, because all the workers in a plant will respond if the union calls a strike. But the large membership may cause problems if different groups of workers within the union develop conflicting interests.

Most labor experts think it is misleading to divide unions into craft and industrial unions because few groups are purely one or the other. The same union may func-

Important United States labor unions*

Name	Membership
†American Federation of Government Employees	218,000
†American Federation of State, County and Municipal Employees	1,300,000
†American Federation of Teachers	1,000,000
American Federation of Television and Radio Artists	80,000
Bakery, Confectionery and Tobacco Workers' International Union	145,000
Bricklayers and Allied Craftsmen, International Union of	106,000
Bridge, Structural, Ornamental, and Reinforcing Iron Workers, International Association of	130,000
†Carpenters and Joiners of America, United Brotherhood of	500,000
Civil Service Employees Association	220,000
Clothing and Textile Workers Union, Amalgamated	262,000
Communications Workers of America	630,000
†Electrical Workers, International Brotherhood of	750,000
Electronic, Electrical, Salaried, Machine, and Furniture Workers, International Union of	140,000
†Engineers, International Union of Operating	400,000
Fire Fighters, International Association of	245,000
Government Employees, National Association of (Ind.)	195,000
Graphic Communications International Union	160,000
†Hotel Employees and Restaurant Employees International Union	370,000
International Longshoremen's Association	88,000
†Laborers' International Union of North America	750,000
Letter Carriers of the United States of America, National Association of	315,000
†Machinists and Aerospace Workers, International Association of	800,000
Major League Baseball Players Association (Ind.)	1,000
†Musicians of the United States and Canada, American Federation of	110,000
†National Education Association of the United States (Ind.)	2,376,000
Office and Professional Employees International Union	140,000
Oil, Chemical and Atomic Workers International Union	100,000
Painters and Allied Trades, International Brotherhood of	162,000
Paper, Allied-Industrial, Chemical and Energy Workers International Union	320,000
Plumbing and Pipe Fitting Industry of the U.S. and Canada, United Association of Journeymen and Apprentices of the	325,000
Police Associations, International Union of	50,000
Postal Workers Union, American	320,000
Retail, Wholesale and Department Store Union	130,000
School Employees, American Association of Classified (Ind.)	200,000
Screen Actors Guild	98,000
†Service Employees International Union	1,400,000
Sheet Metal Workers' International Association	150,000
†Steelworkers of America, United	750,000
†Teamsters, International Brotherhood of	1,600,000
Transit Union, Amalgamated	170,000
Transport Workers Union of America	100,000
Transportation Communications International Union	135,000
Transportation Union, United (Ind.)	150,000
†Union of Needletrades, Industrial and Textile Employees	250,000
†United Automobile, Aerospace and Agricultural Implement Workers of America, International Union	1,300,000
†United Farm Workers of America	50,000
†United Food and Commercial Workers International Union	1,400,000
†United Mine Workers of America (Ind.)	240,000

*Union is AFL-CIO affiliate unless indicated as Independent (Ind.).
†Has a separate article in *The World Book Encyclopedia.*
Sources: Representatives of individual labor unions; *Encyclopedia of Associations.*

tion as a craft union in some branches of an industry and as an industrial union in others. For example, the United Food and Commercial Workers International Union serves as a craft union for skilled butchers in stores. But it is an industrial union in the meat-packing industry, where it represents all workers regardless of the work they do.

The levels of union organization

In most unions, there are three levels of union organization: (1) local unions, (2) national unions, and (3) the American Federation of Labor and Congress of Industrial Organizations (AFL-CIO).

Local unions, often called locals, are the smallest unit of labor organization. A local represents the workers in a particular plant, neighborhood, city, or other area. It is usually the local union that bargains with an employer, though the national union may assist.

Many local unions employ one or more people called business representatives or business agents. These employees work full-time to administer the union's contract and to handle grievances.

The union members in each division of a company elect one of the members to serve as *shop steward.* The steward helps workers deal with management and ensures that union rules are followed in the department. Most local unions also elect an executive board that includes a president, a secretary, and a treasurer.

National unions are made up of local unions throughout the United States. Many national unions are called *international* because they include Canadian locals. National unions promote legislation favorable to their members. They also organize new workers, especially in industries or geographical areas with little union representation. A few national unions, including those in the clothing and steel industries, carry on industrywide bargaining. The bargaining sets wages and hours for the industry, regardless of local conditions.

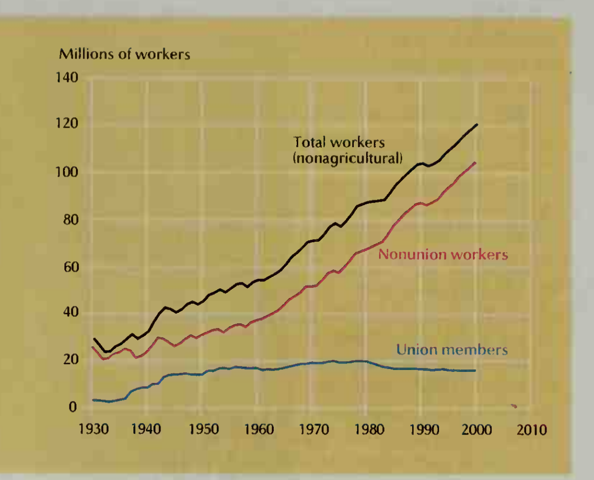
National unions are governed by conventions, to which each local sends representatives. The conventions meet every one to five years. A president, a secretary-treasurer, and an executive council manage union affairs between gatherings. In addition to these officers, most groups have a staff that includes lawyers, public relations experts, and editors. National unions are supported by dues, initiation fees, and other charges paid by members. Union dues vary from one to two hours' wages a month.

The AFL-CIO is a *federation* (league) of national unions. About three-fourths of the union members in the

Union membership in the United States



Year	Total workers (nonagricultural)	Union members	Percent in unions
1930	29,424,000	3,401,000	11.6
1935	27,053,000	3,584,000	13.2
1940	32,376,000	8,717,000	26.9
1945	40,394,000	14,322,000	35.5
1950	45,222,000	14,267,000	31.5
1955	50,675,000	16,802,000	33.2
1960	54,234,000	17,049,000	31.4
1965	60,815,000	17,299,000	28.4
1970	70,920,000	19,381,000	27.3
1975	76,945,000	19,564,000	25.4
1980	87,480,000	20,095,000	23.0
1985	94,521,000	16,996,000	18.0
1990	103,905,000	16,740,000	16.1
1995	110,038,000	16,360,000	14.9
2000	120,786,000	16,258,000	13.5



Source: U.S. Bureau of Labor Statistics.

United States belong to groups that are members of the federation. The president of the AFL-CIO is probably the most powerful American labor leader, but the organization itself does little collective bargaining. Its major activities include promoting legislation favorable to labor, educating the public about the labor movement, and settling conflicts between member unions. For more information about the organization, see **American Federation of Labor and Congress of Industrial Organizations.**

Origins of the labor movement

Various scholars trace the beginnings of the labor movement to different sources. Some historians have compared labor unions with medieval *craft guilds.* The guilds were associations of skilled workers in Europe during the Middle Ages, which lasted from about the A.D. 400's through the 1400's. Other scholars have different theories about the origins of the labor movement.

Craft guilds, like labor unions, worked to establish reasonable wages and hours and to increase job security. But there are important differences between guilds and unions. A guild consisted of ranks of members. The highest-ranking guild members were the *masters,* who had their own shops. They employed less experienced workers called *journeymen* and beginners called *apprentices.* Apprentices and journeymen eventually became masters themselves and had their own employees. Modern labor unions do not include employers, and few union members ever start a business or employ others. Because of these differences, a large number of labor historians think craft guilds and labor unions have little in common.

Other possible origins. One theory is that workers organized to protect themselves against the effects of price competition between companies. Competition among products tends to reduce prices because consumers try to buy at the lowest possible price. As prices fall, companies must reduce costs. The easiest way to do so is to pay workers less, to get more production from them, or a combination of the two. Many scholars believe that workers banded together to keep employers from reducing wages.

Other scholars think workers formed unions because the Industrial Revolution, which began during the 1700's, gave employers too much power. Before the revolution, workers needed only a few tools to go into business for themselves. Many worked in their own homes. Afterward, most people worked in factories, and only wealthy employers or corporations could afford the expensive machinery used to produce goods. Employees may have banded together to equalize bargaining power between themselves and their bosses, who controlled the means of production.

Gains for workers

This chart shows how average working hours and other conditions have changed in the United States since the 1880's.

	1880	Today
Length of workday	10 hours	8 hours or less
Length of workweek	6 or 7 days	5 days
Overtime pay	Almost none	At least one and a half times normal pay
Paid vacations	Almost none	2 to 4 weeks a year
Paid holidays	Almost none	10 a year
Hospital insurance	Paid for by individuals or unions	Paid for at least in part by most employers

Development of the American labor movement

Most historians trace the American labor movement to the early 1800's. During the 1820's and 1830's, carpenters, masons, printers, and other skilled workers established citywide organizations to obtain better pay.

The first nationwide labor organizations developed during the mid-1800's. Workers in many different trades established national unions. William H. Sylvis, a Philadelphia ironworker, founded the National Union of Iron Molders in 1859. In 1867, boot and shoe workers formed a national organization called the Knights of St. Crispin. Blacksmiths, machinists, printers, and other skilled workers also established national unions during

this period, though most of the groups lasted only a few years.

In 1866, Sylvis united a number of national labor unions into a federation called the National Labor Union. But the federation became involved in an ambitious program of social reform and gave little attention to its members' specific needs. It dissolved in 1872.

The first national federation to remain active for more than a few years was the Noble Order of the Knights of Labor. It was established in 1869 by a group of Philadelphia garment workers. The Knights of Labor differed from other labor organizations by including farmers and merchants as well as wage earners. The group's goals included equal pay for equal work, the abolition of child labor, and an 8-hour workday. At that time, most laborers worked about 10 hours a day.

The Knights of Labor reached the height of its power during the 1880's under the leadership of Terence V. Powderly. The group won a strike against railroads owned by the American millionaire Jay Gould in 1885. By 1886, the organization had about 700,000 members. But the Knights lost a second strike against the Gould railroads that year, and membership declined rapidly. By 1900, the group had almost disappeared.

In 1881, Samuel Gompers and other leaders organized a federation that, unlike the Knights of Labor, included only wage earners. It was called the Federation of Organized Trades and Labor Unions of the United States and Canada.

In 1886, the federation was reorganized and changed its name to the American Federation of Labor (AFL). Gompers became the AFL's first president. He served as its president for 37 years—from 1886 to 1894 and from 1896 until his death in 1924.

Under Gompers' leadership, the AFL stressed wage increases and other job demands instead of political issues. The group's chief means of achieving its goals was collective bargaining. Another AFL tactic was the use of marks called *union labels* to identify goods manufactured by its members. The federation urged shoppers to "look for the union label" and buy union-made products.

Opposition to unions increased during the late 1800's. Employers exchanged *blacklists*—lists of workers suspected of union membership—to prevent such workers from getting jobs. Factory owners hired strikebreakers and armed guards to crush strikes. Sometimes, the state or federal government sent troops to end a labor dispute. Many states passed laws to restrict union activity. The Sherman Antitrust Act of 1890, which was designed to prohibit trusts that hindered trade, was used mostly against labor. Union leaders were found guilty of violating that law by interfering with commerce. On this basis, judges issued court orders called *injunctions* forbidding strikes.

In 1886, a disaster known as the Haymarket Riot increased antilabor feeling throughout the country. A meeting of workers was held in Haymarket Square in Chicago to protest police actions against strikers at an industrial plant. Near the end of the meeting, an unknown person threw a bomb, and a riot broke out. At least seven police officers and one civilian died. Many Americans blamed the labor movement for the violence. The police charged eight labor leaders with aiding the unknown person to commit murder. Although the leaders were never found to be the direct cause of the deaths, seven were sentenced to death and the eighth was imprisoned. Four of the seven were hanged, one committed suicide, and the remaining two were resentenced to prison. The three imprisoned leaders were pardoned by Illinois Governor John P. Altgeld in 1893.

Several violent strikes during the 1890's also hurt the labor movement. One of the most bitter was the Homestead Strike of 1892, which involved the Carnegie Steel Company and the Amalgamated Association of Iron, Steel, and Tin Workers. The union called a strike after the company reduced wages at its Homestead, Pa., plant. The company hired guards from the Pinkerton Detective Agency to protect the steelworks. Violence broke out between the strikers and the guards, and several people were killed. The strike failed after most workers quit the union and returned to work.

Another violent dispute was the Pullman Strike of

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The Knights of Labor, established in 1869, was one of the first national labor organizations in the United States. Its members included farmers and merchants as well as workers from many trades.



The Pullman Strike, a railroad strike in 1894, ended after the United States government sent federal troops to keep the mail trains running.

Bettmann Archive

1894. Employees of the Pullman Palace Car Company, which manufactured railroad cars, struck to protest a wage cut. Members of the American Railway Union, a group of railroad workers headed by Eugene V. Debs, declared a sympathy strike. They supported the Pullman strikers by refusing to handle the company's cars. The U.S. government sent troops to end the strike, declaring that it interfered with mail trains. Debs and other leaders were sent to prison, and Debs's union was so weakened that it dissolved three years later.

The early 1900's. The labor movement suffered a number of failures in the early 1900's. One major setback was the case of *Lochner v. New York,* a 1905 ruling of the Supreme Court of the United States. The court held that a law limiting the number of working hours was unconstitutional because it restricted the right of an individual to contract for employment. The court based its decision on the principle that individuals had "liberty of contract" derived from the 14th Amendment to the Constitution. After this ruling, employers used the "liberty of contract" principle to defeat local minimum-wage laws.

The AFL also suffered a major defeat in 1919, when it tried to organize workers in the steel industry. The AFL called a strike for higher wages and other benefits. But the steel companies brought in enough strikebreakers to continue production, and the AFL was forced to cancel the strike. After this failure, AFL membership dropped from about 4 million in 1920 to about 3 million in 1929.

The Industrial Workers of the World. The setbacks of the early 1900's made many labor leaders and workers dissatisfied with the AFL, which accepted the capitalist system and sought benefits within it. To oppose the AFL's conservative policies, radicals founded the Industrial Workers of the World (IWW) in 1905. This group, also known as the Wobblies, sought to overthrow the capitalist system and replace it with socialism. Wobbly composers wrote many songs about the labor move-

United Press Int.



The Industrial Workers of the World (IWW) was a radical labor organization of the early 1900's. It staged many demonstrations like this one in New York City and led a number of violent strikes.

ment and the poor that became popular folk songs. These songs included "Dump the Bosses off Your Back" and "Hallelujah, I'm a Bum."

In 1912, the IWW led a strike by textile workers in Lawrence, Mass., to protest a pay cut. The strikers' food and money soon ran low. To help them hold out, strike leaders sent the workers' children to stay with labor sympathizers in other cities. The strike succeeded, and workers actually won a wage increase.

The IWW was also involved in a strike by silk workers in Paterson, N.J., in 1913. But the Wobblies lost it and a series of others. They nearly disappeared in the late 1920's.

Unions gain strength. Despite the setbacks of the early 1900's, developments near the end of the period led to a later revival. A number of unions abandoned their aims of sweeping social reform. They concentrated instead on higher wages and other job goals, which were easier to achieve and more important to their members. Another development that strengthened unions was the Immigration Act of 1924, which limited the number of immigrants admitted to the United States. The restriction on immigration reduced the number of new arrivals competing for jobs and increased the bargaining power of American workers.

The Great Depression, which began in 1929, left millions of workers jobless. But it also changed the attitude of many Americans toward the labor movement. Before 1929, most people regarded business executives as the nation's leaders and union members as dangerous radicals. But people lost faith in business leaders after business could not relieve the depression. Many Americans began to believe the way to fight the slump was to increase the purchasing power of wage earners. The political climate changed from one favoring management to one favoring labor.

In 1932, Congress passed one of the first prolabor laws. It was called the Norris-La Guardia Act after its sponsors, Senator George W. Norris of Nebraska and Representative Fiorello H. La Guardia of New York. The act made yellow-dog contracts unenforceable and limited the power of federal courts to issue injunctions in labor disputes.

The New Deal, President Franklin D. Roosevelt's program to end the depression, included several laws that benefited labor. One of the most important was the National Industrial Recovery Act of 1933. The act guaranteed workers a minimum wage, reasonable hours, collective bargaining, and the right to join unions. But in the 1935 case of *Schechter v. United States,* the Supreme Court of the United States declared the law unconstitutional.

To replace the overturned law, the federal government enacted the National Labor Relations Act of 1935. The act was also called the Wagner Act, after Senator Robert F. Wagner of New York, who led the fight for its passage. Like the earlier law, the Wagner Act sought to protect labor's right to organize and to bargain collectively. It also established the National Labor Relations Board to administer its provisions. The board was given the power to punish unfair labor practices and to determine which union should represent workers. Many employers believed the Wagner Act was unconstitutional. But the Supreme Court upheld it in a 1937 landmark



Public Affairs Press

A sit-down strike is one in which the strikers stop work but refuse to leave the factory. The strikers shown in the window above took over a General Motors plant at Flint, Mich., in 1937.

case known as *National Labor Relations Board v. Jones and Laughlin Steel Corporation.*

Formation of the CIO. The automobile and steel industries and other industries that used mass-production techniques had expanded rapidly during the early 1900's. As a result, the number of workers in those industries also increased. Most of them lacked union representation. The craft unions that controlled the AFL opposed efforts to unionize these workers, most of whom were unskilled or semiskilled. Many AFL leaders feared that attempts to organize these factory workers would fail, as had attempts to organize steelworkers in 1919.

Nevertheless, several AFL unions established the Committee for Industrial Organization (CIO) to conduct an organizing drive in the mass-production industries. The CIO quickly gained millions of members and unionized workers in many plants that previously had no unions. Its greatest successes were in the automobile, rubber, and steel industries.

But the dispute over industrial organization continued. In 1938, the AFL expelled the unions that formed the CIO. The CIO then established its own federation, changing its name to the Congress of Industrial Organizations. John L. Lewis of the United Mine Workers became the federation's first president.

World War II and the postwar period. The United States entered World War II in 1941. Shortly afterward, President Roosevelt called a conference of the nation's most important labor leaders. The leaders promised to avoid strikes for the duration of the war so that the nation's defense production would not be interrupted.

Union membership soared during the war. By 1945, more than a third of all nonagricultural workers belonged to a union. The government prohibited general

wage increases during the war, but unions won many important fringe benefits. These gains included company-financed hospital insurance, paid vacations and holidays, and retirement pensions.

After the war ended in 1945, the United States entered the greatest period of economic growth in its history. Prosperity spread to more Americans than ever before, and unions took steps to enable their members to share in the new wealth. A wave of strikes began, and the number of work stoppages reached an all-time high in 1946. Unions scored impressive victories, including large wage hikes and the first escalator clauses.

The Taft-Hartley Act. Many Americans began to believe that the unions had become too powerful. They resented the inconvenience caused by strikes and blamed soaring prices on union demands. Many people believed that individual workers were bullied by "strike-happy" union leaders. They demanded a new law to curb the power of organized labor. The result was the Labor-Management Relations Act of 1947, usually called the Taft-Hartley Act. Its sponsors were Senator Robert A. Taft of Ohio and Representative Fred A. Hartley, Jr., of New Jersey.

The Taft-Hartley Act, which Congress passed over the veto of President Harry S. Truman, introduced new government controls over unions. Labor leaders bitterly opposed the legislation, which they called a "slave labor law." It prohibited use of the secondary boycott, sympathy strike, and jurisdictional strike. The act outlawed the closed shop and banned union political contributions in national elections. It increased the amount of support a union needed to establish a union shop. A union needed a majority of the workers eligible to vote instead of a majority of those voting. Finally, the Taft-Hartley Act established cooling-off periods and other special rules for handling strikes that endangered the nation's health or safety.



AFL-CIO

The merger of the AFL and CIO in 1955 united the two leading U.S. labor federations. AFL president George Meany, *left,* and CIO president Walter P. Reuther, *right,* join hands in celebration of the merger of their groups to form the AFL-CIO.

Reunification of the AFL and the CIO. Faced with growing opposition to labor, the AFL and the CIO began to consider joining forces. One of the major differences between the two groups was their attitude toward Communism. The AFL was strongly anti-Communist, but many officials of the CIO either were Communists or supported Communist ideals. These Communist leanings became a problem after World War II, when intense anti-Communist feeling swept through the nation. Many CIO unions overthrew leaders thought to be Communist sympathizers. For example, Walter P. Reuther opposed Communist influence in the United Automobile Workers and became president of that union in 1946. In 1949 and 1950, the CIO expelled 11 unions that it found to be dominated by Communists or Communist sympathizers.

Ridding the CIO of Communist influence removed one of the chief barriers to reunification. Another obstacle disappeared when Philip Murray, the president of the CIO, and William Green, head of the AFL, died in 1952. Both men had played major roles in the split between the two organizations.

George Meany became president of the AFL, and Reuther headed the CIO. The new leaders then began discussion of reunification. In 1955, the two groups merged into a single organization called the American Federation of Labor and Congress of Industrial Organizations (AFL-CIO). Meany became its first president.

Charges of corruption. In 1957, the U.S. Senate formed a committee headed by Senator John L. McClellan of Arkansas to investigate charges of corruption among labor leaders. The investigation revealed that officials of the Teamsters Union and other groups took union funds for their own use and had links with organized crime. As a result of the investigation, the AFL-CIO expelled the Teamsters and two other unions.

In 1959, Congress passed the Labor-Management Reporting and Disclosure Act to guard against corrupt union leadership. The act was also called the Landrum-Griffin Act after its sponsors, Representatives Phillip M. Landrum of Georgia and Robert P. Griffin of Michigan. It gave the government greater control over union affairs by providing for federal supervision of union elections and financial accounts. Individuals who had been in prison could not run for union office until five years after their release. At the insistence of Senator John F. Kennedy of Massachusetts, the act also included a "Bill of Rights" for union members. It guaranteed freedom of speech, control over union dues, and other rights.

The challenge of automation. Beginning in the late 1950's, many factories introduced automatic machinery to perform tasks formerly done by workers. Such automation caused many labor disputes when new machines and methods threatened to eliminate jobs.

Unions called for a variety of measures to protect the jobs and incomes of workers affected by automation. The demands included free retraining and shorter workweeks to spread the available work among more employees. In 1962, the United Steelworkers of America and the Kaiser Steel Corporation agreed to a landmark plan for dealing with automation. The plan called for the



Wide World

Migrant workers and other farm laborers joined the U.S. labor movement during the 1960's. Cesar E. Chavez, a Mexican American labor leader, *front left,* founded what is now the United Farm Workers of America (UFW).

money saved by automation to be shared with workers through higher wages. Laborers replaced by machines would draw full pay until they were retrained or assigned to a new job.

New groups become unionized. Several groups of workers became unionized for the first time during the 1960's and 1970's. Two of the most important were farmworkers and public employees.

Cesar E. Chavez, a Mexican American labor leader, began to organize agricultural workers in California during the 1960's. Chavez established what is now the United Farm Workers of America (UFW), a union of migrant workers and other farm laborers.

In 1962, President John F. Kennedy issued an executive order that gave federal employees the right to organize and to bargain collectively but not to strike. Many states passed similar legislation, and a few even allowed government workers to strike. These laws encouraged the rapid growth of unionism among public employees. By the 1970's, the American Federation of State, County and Municipal Employees, a union of public workers, had become the fastest-growing U.S. labor group.

Union membership among blacks, Hispanic Americans, and women also increased during this period. Unions worked to help them obtain equal pay and other rights. Labor leaders told their members that any group deprived of equal pay would form a cheap source of labor that would compete with union members for jobs.

Recent developments. In the 1980's and early 1990's, labor unions faced the twin challenges of a declining industrial base and increasing automation. Lower labor costs helped foreign companies in the automobile, electronics, and other industries gain larger shares of the American market. Many large U.S. factories in these industries closed, and large numbers of union members lost their jobs. Later in the 1990's, however, the U.S. economy experienced a long period of steady growth. The unemployment rate fell, permitting union membership and bargaining strength to increase somewhat.

Nevertheless, since the late 1940's, the percentage of American workers who belong to unions has declined. In 1945, about 36 percent of all laborers in nonagricultural jobs were members of unions. Today, less than 15 percent are union members.

Critics of organized labor charge that many unions are too big, inefficient, and corrupt. They complain that numerous unions put their members' interests above those of the nation. But other people point out that the same criticisms apply to many other groups.

In the 1990's, the U.S. government took control of several unions, including the International Brotherhood of Teamsters. The government did so in an attempt to reduce union corruption. Its goals included protecting union funds and guaranteeing the fair election of union officers.

Labor around the world

The labor movement is strongest in industrial nations, including Canada, Japan, the United States, and most countries of Western Europe. Less developed countries in Africa, Asia, and Latin America have far fewer labor unions because most of the people work in agriculture.

In Canada, labor unions are usually called *trade unions.* The history of labor in Canada is similar to that in the United States, and unions in both nations are much alike. Most Canadian unions are in a federation called the Canadian Labour Congress (CLC). It includes the Canadian locals of international unions that in the United States belong to the AFL-CIO. A smaller federation, the Confederation of National Trade Unions (CNTU), consists mostly of French-speaking unions from Quebec.

In other countries, the labor movement differs from that in the United States. American unions concentrate on job issues, such as wages and hours. They seek to obtain benefits within the existing free enterprise system. The chief goals of labor groups in most other countries are political and social reform. Unions in France, Italy, and many other countries have socialist aims. They seek to reorganize the political and economic system to achieve *nationalization* (public ownership) of industry.

Labor unions in the United States achieve most of their gains by collective bargaining, but those in most other countries rely more on legislation. In many nations, labor groups have founded their own political party. The unions have little influence if their party loses an election. In the United States, unions have influence with both major parties.

The labor movement in the United Kingdom has traditionally had close ties with the Labour Party. For most of its history, the Labour Party has promoted socialist policies and has brought about many changes in the British economic system. For example, while in power, the party nationalized the coal mines, the iron and steel industry, shipbuilding, and other industries. It also set up an extensive program of pensions, free medical care, and other benefits. However, in 1995, party members voted to drop from the party constitution a statement of commitment to public ownership of industry. The party began moving away from its long-held socialist principles in an effort to win wider support among British voters.

Many British trade unions belong to a federation called the Trades Union Congress. The organization, founded in the 1860's, is similar to the AFL-CIO.

In Japan, most of the unions are *enterprise unions.* Such unions consist of the employees of a particular firm. This type of union developed because, traditionally, many Japanese workers were employed by the same company all their careers. Large firms rarely fired people, and few workers moved from one firm to another. But the tradition of life employment has begun to fade.

In the Soviet Union and other countries of Eastern Europe, the role of labor unions changed in the late 1980's. The unions in those countries had existed mainly to support the aims of government planners and to help meet production goals. The government determined wages and hours, and the power of unions to bargain on behalf of their members was severely limited. In the late 1980's, however, independent labor organizations emerged in Eastern Europe, and workers regained the right to strike.

International organizations. Representatives of labor groups from about 55 nations, including the American CIO, founded the World Federation of Trade Unions (WFTU) in 1945. But the CIO withdrew in 1949, after organizations from Communist countries gained control of the federation. That same year, representatives of the AFL, the CIO, and other labor groups from non-Communist countries established a new federation. This organization, created to oppose the Communist policies of the WFTU, was called the International Confederation of Free Trade Unions (ICFTU). Its goals included the promotion of free unions and better working conditions throughout the world. Daniel Quinn Mills

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Bieber, Owen Frederick
Bridges, Harry
Chavez, Cesar E.
Debs, Eugene V.
Dubinsky, David
Fitzsimmons, Frank E.
Flynn, Elizabeth G.
Fraser, Douglas A.
Galarza, Ernesto
Gompers, Samuel
Green, William
Hill, Joe
Hillman, Sidney
Hoffa, James Phillip
Hoffa, James Riddle
Jones, Mary Harris
Kirkland, Lane
Lewis, John L.
Meany, George
Murray, Philip
O'Reilly, Leonora
Owen, Robert
Owen, Robert Dale
Petrillo, James C.
Randolph, A. Philip
Reuther, Walter P.
Shanker, Albert
Sweeney, John J.
Townsend, Willard Saxby
Woodcock, Leonard

Labor disputes

Arbitration
Boycott
Haymarket Riot
Homestead Strike
Lockout
Pullman Strike
Sabotage
Strike

Labor legislation

Fair Labor Standards Act
National Labor Relations Act
Norris-La Guardia Act
Railway Labor Act
Right-to-Work Law
Taft-Hartley Act

Labor organizations

See the articles on labor unions listed in the *table* with this article. See also:

Air Line Pilots Association
American Federation of Government Employees
American Federation of Labor and Congress of Industrial Organizations (AFL-CIO)
Congress of Industrial Organizations (CIO)
Industrial Workers of the World
International Confederation of Free Trade Unions
International Labour Organization
Knights of Labor
Molly Maguires
Newspaper Guild
Railway Brotherhoods

Government agencies

Federal Mediation and Conciliation Service
Labor, Department of
National Labor Relations Board
National Mediation Board

Other related articles

Apprentice
Automation
Blacklist
Child labor
Closed shop
Coal (Labor unions)
Guild
Hamilton, Alice
Industrial relations
Industrial Revolution (The working class)
Industry (Labor)
Labor Day
Labor force
Labour Party
Lochner v. New York
Migrant labor
Minimum wage
Open shop
Pension
Productivity
Profit sharing
Racketeering
Railroad (Rail unions)
Sweatshop
Syndicalism
Union shop
Wages and hours
Wałęsa, Lech

Outline

I. What labor unions do
- A. Organizing workers
- B. Arranging contracts
- C. Handling labor disputes
- D. Conducting apprenticeship programs
- E. Other union activities

II. Types of unions

III. The levels of union organization
- A. Local unions
- B. National unions
- C. The AFL-CIO

IV. Origins of the labor movement
- A. Craft guilds
- B. Other possible origins

V. Development of the American labor movement

VI. Labor around the world
- A. In Canada
- B. In other countries
- C. International organizations

Questions

When did fringe benefits develop?
What is the difference between a *closed shop,* an *open shop,* and a *union shop*?
Who was Samuel Gompers?
What are the three levels of union organization?
Why did the AFL expel unions that set up the CIO?
What is the difference between *mediation* and *arbitration*?
Why is there a special agency to settle labor disputes in the railway and airline industries?
How have the goals and methods of the labor movement in most other countries differed from those in the United States?
What is the difference between *craft unions* and *industrial unions*?
What tactics other than a strike can a union use to press its demands?

Additional resources

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Labor Party. See Labour Party.

Labor Statistics, Bureau of (BLS), is an agency of the United States Department of Labor. It collects and interprets information about the labor force and the performance of the economy.

The bureau conducts research on employment and unemployment, productivity and technological developments, economic growth, wages, industrial relations, work injuries, prices and living conditions, and foreign labor and trade. This information is used by labor, industry, other government agencies, and the public. It appears in the BLS publication, the *Monthly Labor Review,* and in bulletins, reports, and special periodicals.

The agency was established in 1884 as the Federal Bureau of Labor. It received its present name in 1913.

Critically reviewed by the Bureau of Labor Statistics

Labor union. See Labor movement.

Laboratory is a place equipped with apparatus for conducting experiments, investigations, and learning activities. Many devices and products used in everyday life result from laboratory work. They include compact discs, computers, disease-killing drugs, and synthetic fibers. Laboratories may be found in schools, research institutes, industrial organizations, and government departments. They provide a place for discovering new knowledge and serve as a training ground for scientists and students in many fields. See also **Chemistry** (The work of chemists); **Language** (picture: A language laboratory). Ronald C. Johnson

Laboratory school is a school used for the observation and study of children, and for the evaluation of teaching methods. It is sometimes called a *campus school,* because it is usually located on the campus of a college or a university. It may be an elementary school, a high school, or a combination of the two.

The laboratory school carries on all the functions of a regular public school. It also provides opportunity for one or more of the following activities: (1) College students in education can observe children and teaching methods. (2) Students can practice teaching under the supervision of experienced teachers. (3) College staff members and students can do research and experimentation in teaching methods. Donald H. Eichhorn

Laborers' International Union of North America, formerly called the Hod Carriers' Union, is a trade union affiliated with the American Federation of Labor and Congress of Industrial Organizations. The union has more than 800 locals in the United States and Canada. It consists primarily of building and construction workers who perform helpers' tasks for other crafts. For example, membership is open to tenders for carpenters, plasterers, and masons; to workers who mix or handle construction materials; and to general laborers. The union was organized in 1903. Its headquarters are in Washington, D.C. For membership, see **Labor movement** (table: Important United States labor unions). James G. Scoville

Labour Party is one of the two main political parties in the United Kingdom. The Conservative Party is the other one. The Labour Party has traditionally received much support from working class voters, especially trade union members. For most of its history, the party has promoted socialist policies and has brought about many changes in the British economic system. But in the mid-1990's, the party moved away from its long-held socialist principles in an effort to win wider voter support.

History. The number of British working-class voters was increased by the Reform Acts of 1867 and 1884. But unlike the socialist workers on the European continent, British workers did not at first favor independent political action. The Labour Party did not begin to take shape until the late 1800's. This occurred under the leadership of several groups, particularly the Fabian Society and the Independent Labour Party. In 1900, a Labour Representation Committee was formed. It included representatives of trade unions and socialist groups. The Labour Party elected 29 candidates in 1906, but its growth was uneven. In World War I (1914-1918), some of its leaders alarmed the country by their pacifism.

After the war, the party declared itself in favor of socialism. Its membership grew, and, in 1924, James Ramsay MacDonald formed the first Labour government. But the Labour Party still depended on Liberal votes for its majority in the House of Commons, so it had little chance to follow an independent policy. In 1931, MacDonald and other Labourites formed a coalition government to combat a severe depression that had struck the country. They were then expelled from the Labour Party.

In World War II (1939-1945), Labour joined with Winston Churchill's government to carry the nation to victory. After Germany's defeat in 1945, cooperation ended, and an election was held. Labour won by a large margin, and Clement Attlee became prime minister. Attlee led the party from 1935 to 1955. From 1945 to 1951, a Labour government under Attlee carried out much of the party's program. It passed laws *nationalizing* (placing under government control) about one-fifth of the country's industry. It also provided more social services. New and revised programs extended insurance and pension coverage. The National Health Service Act provided for free medical and dental care for the entire population.

The Conservatives regained control of Parliament in 1951 and held it until 1964. Labour Party leader Harold Wilson became prime minister in 1964. The party was defeated by the Conservatives in 1970 but returned to power in 1974, still headed by Wilson. Wilson retired in 1976. James Callaghan became Labour leader and prime minister. In 1979, the Conservatives regained control of Parliament. Callaghan's term as prime minister ended. Callaghan retired as party leader in 1980.

After its 1979 election defeat, the party suffered internal conflicts over policy. A number of right-wing members left it and formed a party that later merged with the Liberal Party to form the Social and Liberal Democratic Party, now called the Liberal Democrats.

Recent developments. In 1994, Tony Blair became head of the Labour Party. In 1995, party members voted to drop from the party's constitution a statement of commitment to "common ownership of the means of production, distribution, and exchange." Dropping this statement of socialist principles was intended to broaden the party's appeal beyond the working class. In a 1997 national election, the party won by a landslide over the Conservatives, and Blair became prime minister. In elections in 2001, the Labour Party repeated its victory, and Blair retained his post.

In other countries. Other countries that have a Labour (or Labor) Party include Australia, Ireland, Israel, the Netherlands, New Zealand, and Norway. Canada

until 1961 had a farmer-labor party called the Co-operative Commonwealth Federation. That year, the party and the Canadian Labour Congress united to form the New Democratic Party. Labour (or labor) parties have never been powerful in the United States. But a few had influence in certain localities. The American Labor Party was most active in New York City in the 1930's. The Farmer-Labor Party of Minnesota was most active in the 1920's and 1930's. The Socialist Labor Party, founded in 1877, still chooses a presidential candidate. Robert E. Dowse

Related articles in *World Book* include:

Attlee, Clement R.
Blair, Tony
Bondfield, Margaret Grace
Fabian Society
Kinnock, Neil G.
Laski, Harold J.
MacDonald, James Ramsay
Webb, Sidney and Beatrice
Wilson, Harold

Labrador is a large peninsula in northeastern Canada. It covers about 500,000 square miles (1,300,000 square kilometers) between the Atlantic Ocean and Hudson Bay. The western part belongs to Quebec. The so-called eastern "coast" forms part of the province of Newfoundland and Labrador. Since 1927, the term "coast" has meant the large area drained by rivers flowing eastward to the Atlantic. This article discusses the part of Labrador that belongs to Newfoundland and Labrador. That part covers 113,641 square miles (294,330 square kilometers).

Labrador extends farther east than any other part of the North American mainland. The Strait of Belle Isle in the southeast separates Labrador from the island of Newfoundland. Labrador has long, severe winters. In the interior, snow covers the ground from September to June. The brief summers, however, can be hot. The rugged coast is washed by the cold Labrador Current. It is icebound from November to June. Labrador has an abundant supply of fish, iron ore, and other resources.

Inuit (formerly called Eskimos) and Naskapi and Montagnais Indians were the first inhabitants of Labrador. Traditional ways of life of these *aboriginal* (native) peoples have been almost completely changed through contact with Europeans, but they still mainly fish and trap for a living. Labrador's rich fishing areas attracted the Europeans, who began establishing seasonal fishing communities in the early 1500's. Today, many tiny coastal settlements still depend on fishing. The people rely on supplies brought from other parts of Canada for nearly all their food except fish and game meat. Rich iron ore deposits make Labrador an important mining center. Labrador sends three representatives to the Newfoundland and Labrador provincial legislature. Until 2001, the province was officially known simply as Newfoundland.

Land and climate

Labrador lies on a rough plateau of ancient rock formations. Valleys and rapid rivers draining into the Atlantic have deeply cut the coastal edge of the plateau. The 600-mile (970-kilometer) Churchill River is the largest river of Labrador. Churchill Falls on the Churchill helps generate the chief source of hydroelectric energy. Lakes cover much of southwestern Labrador.

The highest mountains in Labrador rise in the northeastern coastal region. Mount Caubvick (also called Mont d'Iberville), which is the highest point in Newfoundland and Labrador, rises 5,322 feet (1,622 meters) in the Torngat Mountains in northern Labrador. See **Newfoundland and Labrador** (physical map).

Labrador has about 21,000 square miles (55,500 square kilometers) of valuable timber. The main forest trees are black spruce, balsam fir, and birch. Commercial use of the forests is limited by their inaccessibility to business areas. Wild animals include caribou, bears, beavers, foxes, hares, lynxes, martens, minks, moose, otters, porcupines, squirrels, weasels, and wolves. Cod, herring, seals, and trout are caught in the coastal waters. Ducks and geese and other migratory water birds visit Labrador each year.

Temperatures in Labrador fall below freezing almost every month of the year. Temperatures on the coast sometimes fall as low as −40 °F (−40 °C) in winter, and occasionally rise to over 80 °F (27 °C) in summer. The northern coast and the interior have especially severe winters. In summer, drifting ice from the Arctic may chill the coast while the interior remains warm. Labrador has an annual average *precipitation* (rain, melted snow, and other forms of moisture) of about 35 inches (90 centimeters). Labrador receives about 180 inches (457 centimeters) of snow each year. The coast has frequent storms,



© William Curtsinger, Photo Researchers

Small fishing villages, such as this one, lie on Labrador's Atlantic coast. Many people of Labrador rely on fishing as a chief source of income.



The Labrador Peninsula lies in northeastern Canada. Most of the peninsula is in Quebec. The eastern part belongs to the province of Newfoundland and Labrador.

WORLD BOOK maps



especially during the autumn and winter months, when gales often blow.

People and economy

Labrador's population, based on the 2001 Canadian census, is 27,864. Labrador's largest communities are Happy Valley-Goose Bay, Labrador City, and Wabush. About three-fifths of the people live in these communities. Labrador City and Wabush are mining towns. Happy Valley-Goose Bay grew up around an air force base established during World War II (1939-1945). The base is now used as a training center by North Atlantic Treaty Organization (NATO) countries.

Whites make up about 70 percent of Labrador's population. Aboriginal peoples account for about 30 percent.

Labrador has large deposits of iron ore. There are also significant deposits of nickel, copper, and cobalt near Voisey's Bay in northern Labrador.

The Labrador Trough, a belt of land rich in iron ore, crosses the western edge of Labrador. It extends 1,700 miles (2,740 kilometers) in a vast horseshoe through central Quebec, Labrador, and the Hudson Bay region. Labrador's part of the Trough alone has iron ore deposits estimated at over 8 billion tons (7 billion metric tons).

In the 1940's, exploration of the Knob Lake area on the Labrador-Quebec frontier uncovered about 400 million tons (360 million metric tons) of high-grade iron ore. The Quebec, North Shore, and Labrador Railway brings this ore to markets. The railway runs through western Labrador from Schefferville, Quebec, just north of western Labrador, to Sept-Îles, Quebec, a port on the Gulf of St. Lawrence. A branch runs to iron ore deposits near Carol and Wabush lakes. Ships carry the ore to steel mills in other parts of Canada and in the United States.

Labrador is also an important fishing area. Shellfish, particularly snow crab, northern shrimp, and scallops, have become the major commercial fish catch in the region. Cod had long been the most valuable fish catch. But because of overfishing, the Canadian government has restricted cod fishing since the early 1990's. Arctic char, Atlantic salmon, and trout are also valuable fish. But the government closed the commercial salmon and arctic char fishery due to overfishing. The Inuit people still catch Arctic char to meet community needs.

The immense potential of the Churchill River was tapped in 1971 when a hydroelectric plant began operating at Churchill Falls. The plant has a capacity of $5\frac{1}{2}$ million kilowatts of electric power and is one of the largest plants in the Western Hemisphere. Most of its power is sold to Quebec at a low fixed price, and much is then resold to the state of New York. As a result, the province of Newfoundland and Labrador profits little from the power. The province is working to gain a greater share of the profits.

Labrador has three airports, at Churchill Falls, Happy Valley-Goose Bay, and Wabush. Most of Labrador's isolated communities maintain gravel airstrips that are used the year around. When the coast is ice-free, from June to November, the provincial government maintains a steamer and motorboat coastal service. It provides passenger service and carries mail and supplies.

History

Viking explorers probably first visited Labrador between A.D. 950 and A.D. 1000. John Cabot, an Italian explorer in the service of England, probably sailed to Labrador shortly before 1500. The origin of the word *Labrador* may be linked to Cabot's voyages. According to tradition, a farmer from the Azores (Portuguese islands) sailed with Cabot. The Portuguese word for farmer is *llavrador.* This may account for the name *Labrador,* but no one is sure of its origin. Many other European explorers visited Labrador after Cabot.

Until the 1700's, only Inuit and Naskapi and Montagnais Indians of Algonquian origin lived permanently in Labrador. Basque fishing crews established whaling stations on the north shore of the Strait of Belle Isle during the early 1500's, but these settlements were seasonal. Jacques Cartier explored southern Labrador for France in 1534, but the French made no permanent settlements. Fishing and whaling crews from France and other countries continued to visit Labrador. In 1763, the Treaty of Paris officially gave Labrador to Britain (now the United Kingdom).

In 1771, Moravian missionaries from Germany settled at Nain in the north to begin missionary work with the Inuit. Both the native people and the European settlers of Labrador lived in extreme hardship. In 1892, Wilfred T. Grenfell, a British medical missionary, was sent to Labrador. Many residents of Labrador suffered from illness and had little medical care. Grenfell treated many patients and made the suffering of the people known to the outside world. He obtained funds to establish hospitals, schools, and cooperative stores in Labrador. Grenfell's program of mercy continues to operate today through the International Grenfell Association.

Newfoundland (now Newfoundland and Labrador) and Quebec disputed the ownership and boundaries of the Labrador interior as interest in the area's resources grew. In 1927, the British Privy Council finally settled this question by defining the present boundaries in favor of Newfoundland. It interpreted the term "coast" as "watershed." Thus, Newfoundland gained control over the area of Labrador that was drained by rivers flowing into the Atlantic Ocean along the east coast.

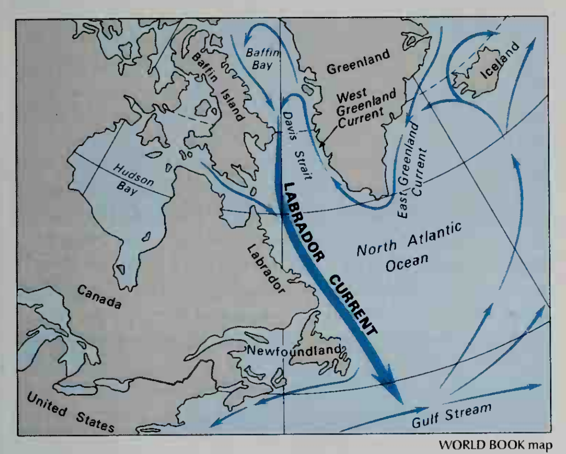
During World War II (1939-1945), the U.S. Army arranged with the United Kingdom to station American

troops in Labrador to keep Nazi submarine raiders from using the coastal waters as a base. Newfoundland became a province of Canada in 1949. Industrial companies then began to develop its rich natural resources.

In 1971, a large hydroelectric plant began operating on the Churchill River at Churchill Falls. See the *People and economy* section of this article for more details. In 2001, the name of the province was officially changed to Newfoundland and Labrador. Simon M. Evans

See also **Churchill River; Grenfell, Sir Wilfred T.; Labrador Current; Newfoundland and Labrador.**

Labrador Current is a cold ocean current that rises in the Arctic Ocean. After waters from Hudson Bay join the current, it flows along the shores of Labrador to a point near the island of Newfoundland, where it meets the Gulf Stream. The influence of the Labrador Current is felt as far south as New England. The harbors of Labrador are blocked with ice for about half the year, partly because of this cold current. But the ports of the United Kingdom and Ireland, which have the same latitude as Labrador, remain open to shipping throughout the year. When cold air above the Labrador Current meets the warm, moist winds above the Gulf Stream,



The Labrador Current flows along the eastern shore of Labrador and the island of Newfoundland. It is formed in the Davis Strait by converging cold currents.

heavy fogs form off the coast. Mark A. Cane

See also **Fog; Ocean** (How the ocean moves).

Labrador retriever is a popular breed of dog trained to bring back game that has been shot. It originally came from Newfoundland, not Labrador. It was developed in England. The Labrador has two outstanding characteristics, its coat and its tail. The coat is thick and water-resistant. It is usually black, but may be yellow or chocolate. The dog's tail is short and unusually thick at the base.
Critically reviewed by the Labrador Retriever Club

See also **Dog** (picture: Sporting dogs); **Dog guide.**

Labrador tea is the name of five kinds of small evergreen plants in the heath family. They grow in the wet meadows, bogs, and forests of temperate and subarctic regions of the Northern Hemisphere. The leaves of these plants have been used for tea and as a substitute for hops in making beer. However, they are poisonous to grazing animals. Tannin, used in tanning animal hides, also comes from the leaves. James L. Luteyn

Scientific classification. Labrador tea plants are members of the heath family, Ericaceae. These plants make up the genus *Ledum.*

See also **Flower** (picture: Flowers of woodlands).

La Brea tar pits, *luh BRAY uh,* are one of the world's richest known sources of fossils from the most recent ice age. The ice age ended about 11,500 years ago, marking the end of the Pleistocene Epoch. The fossils lie in Hancock Park in Los Angeles. Beginning in 1906, when the remains of a giant prehistoric bear were found, about a million well-preserved skeletons of saber-toothed tigers, giant wolves, llamas, camels, horses, giant ground sloths, and other ancient animals have been dug from the various layers of oil and tar. These animals became trapped when they came to drink from the shallow pool that covered the sticky asphalt bog. Some Indians of the area used the pitch to cover baskets and canoes. Spanish settlers waterproofed adobe houses with it. The George C. Page Museum, at the site, displays skeletons from the pits. Brian M. Fagan

La Bruyère, *la broo YAIR,* **Jean de,** *zhahn duh* (1645-1696), was a French satirist. He is best known for *The Characters of Theophrastus, Translated from the Greek, with the Characters and Mores of This Age.* The book appeared in 1688 as an appendix to his translation of a work by Theophrastus, an ancient Greek philosopher. In each of the nine editions published during his lifetime, La Bruyère increased his own contribution so that the *Characters* stands as an original work. He ridiculed the injustice and hypocrisy he saw in French life. The *Characters* illustrates the classical French ideal of polished taste derived from common sense, and simple truth attained by observing human nature. La Bruyère grouped his observations under 16 chapter titles, including "The City," "The Court," "Fashion," and "Personal Merit."

La Bruyère was born in Paris in August 1645. In 1693, he was admitted to the French Academy. He died in May 1696. Robert B. Griffin

Laburnum, *luh BUR nuhm,* is a small tree with bright yellow blossoms. Its glossy leaves remain green until late in the autumn. Each leaf is made up of three leaflets. The plant's seeds qrow in thin pods. The *common laburnum,* native to Asia, is sometimes called *golden chain* because of its long clusters of yellow flowers. It is used widely as a garden or landscaping plant. This kind of laburnum is somewhat sensitive to cold. The *Scotch laburnum* is native to southern Europe. It is hardier than the common laburnum and has longer flower clusters. Laburnums have hard, fine-grained wood. The seeds, roots, and other parts of these trees contain a poisonous substance called *cytisine.* Linda B. Brubaker

Scientific classification. Laburnums belong to the pea family, Fabaceae or Leguminosae. The scientific name for the common laburnum is *Laburnum anagyroides.* The Scotch laburnum is *L. alpinum.*

Labyrinth, in anatomy. See Ear (The inner ear).

Labyrinth, *LAB uh rihnth,* was a place with many confusing paths and passageways. According to Greek mythology, Daedalus built it for King Minos of Crete. Minos wanted it as a prison for the monster called the Minotaur. He sacrificed seven Athenian youths and seven maidens to the Minotaur every year.

Theseus, the son of an Athenian king, went into the



Ronald Sheridan

The Cretan labyrinth is pictured on this ancient coin. According to mythology, the maze was built to imprison the Minotaur.

Labyrinth, killed the Minotaur, and found his way out of the twisting passages. Ariadne, Minos' daughter, had given him a ball of thread to unwind as he went in. He followed the thread and escaped.

Archaeologists have discovered a palace that may have been the site of the Cretan Labyrinth. The palace is located in the Cretan city of Knossos. It has many passageways and resembles the mythical Labyrinth. Many double axes were found at the palace. Most scholars believe that the word *labyrinth* came from *labrys,* which means *double axe.* Later, the term *labyrinth* came to mean any place that contained many confusing passageways. Archaeologists have also found traces of another great labyrinth in Egypt.

Buildings with confusing and seemingly endless networks of passages are found in some amusement parks. A modern labyrinth of this nature is sometimes called a *maze* and is used for testing skill in problem solving. Many toys and games are based on the idea of the labyrinth or maze. Psychologists use mazes in experiments to test the reactions of animals (see **Learning** [Multiple-response learning]). William F. Hansen

See also **Minotaur**; **New Harmony** (picture).

Lac is a sticky substance given off by a kind of scale insect. The insects gather by the hundreds of thousands on the twigs and branches of the soapberry and acacia trees of India, Thailand, and Burma (see **Scale insect**). The sticky substance these insects secrete is called *lac.* The term comes from a Hindustani word meaning *hundred thousand.* Shellac is made from lac (see **Shellac**).

Lac insects pierce the bark of trees with their long beaks and feed on the sap. As they do so, they discharge a quantity of lac to protect themselves from their enemies. The female insect lays several hundred eggs before she dies. The young insects hatch as wormlike *larvae.* When the larvae grow into insects, they look for new, fresh twigs to feed on. This period in their life cycle is called *swarming.*

Lac is usually harvested by cutting almost all the twigs before the larvae mature. When the larvae are ready to swarm, the twigs are fastened onto trees where the workers want the insects to feed. The crude substance gathered from the twigs is called *stick lac.* Workers grind it between stones and wash it in water to remove the coloring matter. In this stage, the substance is called *seed lac.* Seed lac is processed either by hand, by machine, or through bleaching in hot sodium carbonate.

Shellac is made by dissolving processed lac in alcohol. Shellac is used in electric insulators and varnishes and to hold together pharmaceutical tablets and hard candies. Shellac is also used in printing ink and for hat stiffening. Roger D. Barry

Laccadive Islands, *LAK uh DYV,* are a group of tiny coral islands off the southwestern coast of India. They occupy about 7 square miles (18 square kilometers) in the Arabian Sea and are part of the Union Territory of Lakshadweep, formerly known as Laccadive, Minicoy, and Amindivi Islands Territory. For location, see **India** (physical map). The Union Territory covers about 12 square miles (32 square kilometers) and has a population of about 51,700. Most of the people in the territory live on the Laccadive Islands. The rest inhabit the Amindivi Islands.

Most of the islanders speak the Malayalam language, but they belong to various Arabian tribes. The women make an elastic fiber called *coir* from coconut husks. Coir is used in the manufacture of matting. The men build boats and trade on the mainland. They exchange their copra and coconut fiber chiefly for rice, their principal food. Robert LaPorte, Jr.

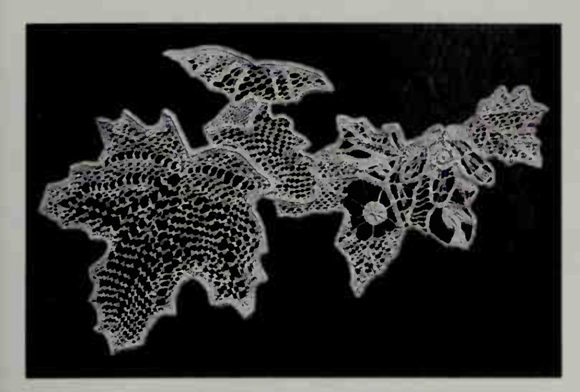
Lace is a decorative fabric that consists of an open, netlike pattern of threads. The finest lace is made of linen thread, but cotton, silk, wool, manufactured fibers, and even threads of gold and silver are also used. The design on most types of lace consists of patterns of flowers or leaves. Other designs feature animals, human figures, or such objects as columns and scrolls. Lace is used mainly to decorate clothing and to make ornamental items for homes and churches.

Most lace is made by machine, but the fabric was originally made by hand. Handmade lace is classified ac-



The Lace Museum, Mountain View, Calif.

Lace is a decorative, netlike fabric that has many uses. This photograph shows dresses, Christmas tree ornaments, a curtain, a window drapery, and a tablecloth—all made of lace.



Venetian lace is one of the oldest types of needlepoint lace. This floral design was made in a style called *point de Venise.*



Appliqué lace is made by stitching pieces of muslin on netting. This appliqué lace was made in England.



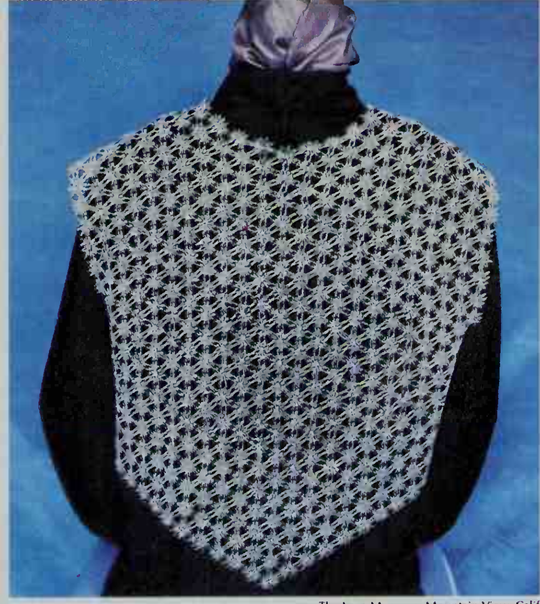
Valenciennes lace is a soft, delicate bobbin lace that was made in France and Flanders during the 1700's and 1800's.



Honiton lace is a type of bobbin lace named after the town in England where it was produced in the 1700's and 1800's.



Brussels lace called *point-de-gauze* is a fine, light needlepoint lace. Point-de-gauze was especially popular during the 1800's.



The Lace Museum, Mountain View, Calif.

Tatting is lace made by looping and knotting cotton or linen threads with a shuttle. A tatted ladies' vest is shown above.



© Michael Philip Manheim from Marilyn Gartman
Bobbin lace is made by hand in Italy, *shown here.* The lacemaker works bobbins around a design outlined by small pegs.

cording to the way it is made. The two main types are *needlepoint lace* and *bobbin lace.* In making needlepoint lace, the lacemaker draws the design on parchment and sews it on a linen backing. Then he or she uses a needle and thread to fill in the pattern with embroidery stitches. For bobbin lace, the design is drawn on parchment attached to a pillow. To make the lace, the lacemaker uses many bobbins of thread. The thread is worked around small pins that are stuck into the pillow along the lines of the design.

Lace can also be made in a number of other ways. For example, knotted threads are used in making a kind of lace called *tatting.* Techniques similar to those used in knitting are involved in creating *crochet lace. Tambour lace* is made by embroidering designs on netting. Lacemakers stitch pieces of muslin on netting to make *appliqué lace.*

Most handmade laces were named for the place where they were first made. One famous kind of needlepoint lace is Alènçon, made in Alènçon, France. Other outstanding needlepoint laces are Argentan, Brussels, and Venetian. Well-known bobbin laces include Chantilly, Mechlin, and Valenciennes, all named for cities in Belgium and France.

The art of lacemaking developed in Europe during the 1500's. Italy and Belgium were the chief centers of early lacemaking. During the early 1800's, British inventors developed the bobbin net machine. This machine became the basis for many of the machines used today in making lace. Rachel E. Wareham

See also **Crochet.**

Lacedaemon. See Sparta.

La Ceiba, *lah SAY bah* (pop. 61,900), a chief Caribbean port of Honduras, lies 115 miles (185 kilometers) north of Tegucigalpa (see **Honduras** [map]). It is a distribution center for the products of north and northeast Honduras. Industries in La Ceiba produce footwear, cigars, soap, and coconut oil. Chief exports include bananas and pineapples. Gary S. Elbow

Lacewing is an insect with thin and delicate wings. The two main kinds are green lacewings and brown lacewings. Some green lacewings have golden eyes, and some give off strong odors. Brown lacewings have brown eyes and wings.

The *larva* (young form) of the lacewing has large, sickle-shaped jaws. It captures and feeds on aphids, scales, and other insects, and even on the eggs of other lacewings. Some larvae, called *aphid lions,* are used by farmers to kill agricultural pests. The full-grown larva spins a silk cocoon. James E. Lloyd

Scientific classification. Lacewings belong to the order Neuroptera. Common species belong to the brown lacewing family, Hemerobiidae, and the green lacewing family, Chrysopidae.

See also **Insect** (picture: Familiar kinds of insects); **Larva** (picture).



E. R. Degginger
The lacewing is a delicate insect named for its two pairs of lacy wings. The insect has large golden-bronze eyes.

Lachesis. See Fates.

Lackland, John. See John (king of England).

Lackland Air Force Base, Texas, provides six weeks of basic training for all men and women who enlist in the United States Air Force. The base also offers beginning training for officer candidates who have not graduated from the Air Force Academy or the Reserve Officer Training Corps. Foreign students receive English language instruction at the base, and security police are trained there.

Lackland Air Force Base covers about 6,800 acres (2,800 hectares) southwest of San Antonio. It began in 1941 as a World War II (1939-1945) officer training school at Kelly Air Force Base and became a separate base in 1942. Since 1946, Lackland Air Force Base has offered basic training. The base is named for Brigadier General Frank D. Lackland, who commanded the flying school at Kelly Air Force Base during World War II.
Wayne Thompson

Lacquer is a shiny, protective film used on metals, woods, and porcelain. Lacquer is made from compounds of cellulose, resin, or lac.

Lacquer made with resin is called a true "spirit" varnish. The resin is usually mixed with turpentine. The turpentine evaporates when it is exposed to air, leaving only the coating of resin on the material. When a cellu-



Song dynasty (960-1279), China; Field Museum of Natural History (Diane Alexander White)

A Buddhist head was carved from hardened lacquer.



Carved red lacquer plate (1573-1620); Art Institute of Chicago, gift of Mr. and Mrs. Philip Pinsof, 1961

A Chinese lacquerware plate is decorated with a carved dragon and flowers. It was made during the Ming dynasty.

lose compound is used to make lacquer, the compound is usually dissolved in butyl alcohol or butyl acetate. The butyl compounds also evaporate when exposed to air. When lac is used to make lacquer, the evaporating solution used is ethyl alcohol. These lacquers are made in all colors that are commonly found in paints.

In Asia, a natural lacquer is taken from the sap of the lacquer, or varnish, tree. The Japanese and Chinese tap the tree and collect the sap. Then they strain the sap and dry it by heat. This makes a dark brown liquid as thick as syrup. The liquid is diluted and sometimes colored before it is used as lacquer.

Modern lacquers are used to finish thousands of materials. The paper industry uses both clear and colored lacquers to finish packages, labels, and book covers. In the furniture industry, lacquers are especially useful in retaining the color of blond furniture. In addition, they give a waterproof finish to furniture. In the auto industry, lacquers are used to give a high gloss to car finishes. Acrylic-resin lacquers make an excellent coating for brass and chromium. Roger D. Barry

See also **Cellulose; Lac; Resin; Varnish.**

Lacquerware is a decorative object made by coating an article, such as a box, dish, tray, or vase, with many layers of varnish. The varnish forms a durable, glossy, waterproof surface that can be painted, carved, or decorated in other ways. Varnishes used to make lacquerware include *lacquer* and *shellac.* They may be clear or colored. Some objects have 200 coats of varnish.

The art of making lacquerware developed in China, where lacquer probably was first produced. Chinese lacquer objects date from as early as 300 B.C. The Japanese learned the art from the Chinese, probably during the A.D. 500's. In the early 1600's, China and Japan began exporting lacquerware boxes, chests, cups, screens, and other items to Europe. European artists soon began making lacquerware, but they used shellac instead of lacquer. During the 1700's, trade flourished in Europe for shellac-based European lacquerware. However, the finest lacquerware articles were still made in China and Japan. William C. Gates, Jr.

See also **Lacquer; Shellac.**

Lacrimal gland. See Tears.

La Crosse, Wisconsin (pop. 51,818; met. area pop. 126,838), is a manufacturing and trading center at the junction of the La Crosse, Black, and Mississippi rivers in the southwestern part of the state. For location, see **Wisconsin** (political map). It is Wisconsin's largest city on the Mississippi. The city is named after the Indian game of lacrosse. Founded in 1842 and chartered as a city in 1856, La Crosse became a sawmill center and a trading hub. Today, the city's factories make aircraft instruments, beer, clothing, heating and air conditioning equipment, and rubber footwear. La Crosse is one of the leading health care centers in Wisconsin.

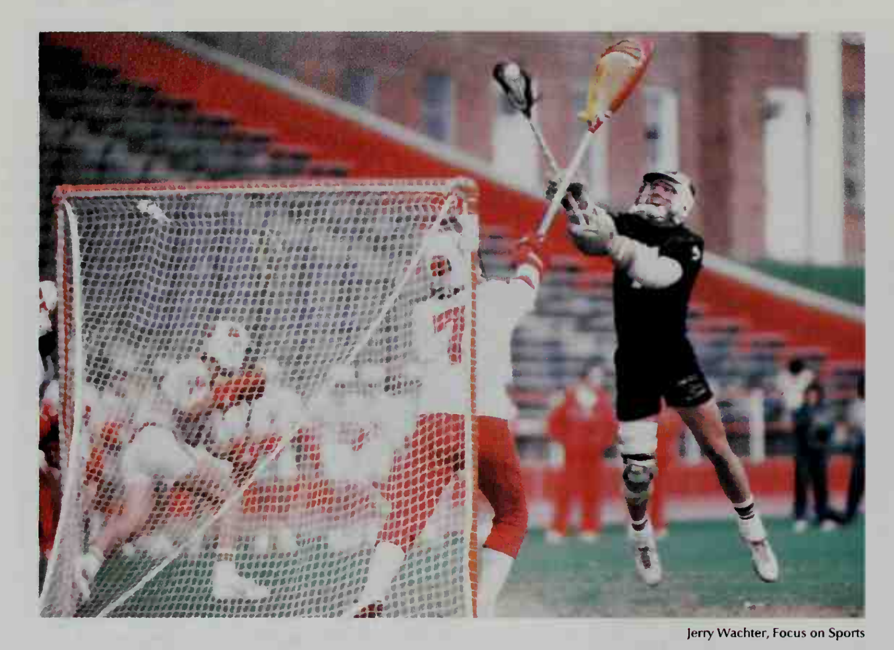
Viterbo College, a campus of the University of Wisconsin, and a technical college are in La Crosse. The city's best-known festival is Oktoberfest, a celebration of German culture. La Crosse has a mayor-council government. It is the seat of La Crosse County.

Gary C. Meyer

Lacrosse, *luh KRAWS,* is a fast team sport played with a ball and sticks with net pockets. It is the oldest continuously played sport in North America. Lacrosse is also played in such countries as Australia, Canada, the Czech Republic, Germany, Japan, and Sweden, as well as in England, Scotland, and Wales.

Lacrosse rules vary from country to country, and according to the players' level of expertise. Lacrosse is most popular in the United States as a college and high school sport. This article mainly discusses lacrosse as it is played at the college level in the United States.

In lacrosse, players try to score a goal by throwing the ball into the opposing team's goal. Men's teams consist of 10 players—3 defensemen, 3 midfielders, 3 attackmen, and a goalkeeper. Women's teams consist of 12 players, including attackers, midfielders, defenders, and a goalkeeper. Players move the ball by throwing it with their sticks. In both men's and women's lacrosse, only the goalkeeper may touch the ball with the hands.



Jerry Wachter, Focus on Sports

Lacrosse is a fast team sport. Players use a stick with a net pocket at one end to move the ball down the field. A team scores by putting the ball into the opponent's goal.

The field and equipment. Men's lacrosse is played on a field 110 yards (101 meters) long and 60 yards (55 meters) wide. There are no specific dimensions for a women's field, but the desirable size is 120 yards (110 meters) long and 70 yards (64 meters) wide.

The stick, called a *crosse*, can be made of wood, laminated wood, or a synthetic material. At the end is a net pocket. The ball is made of solid rubber. The ball for both men and women must be between 7 $\frac{3}{4}$ and 8 inches (19.7 and 20.3 centimeters) in circumference and weigh 5 to 5 $\frac{1}{4}$ ounces (142 to 149 grams).

Because men's lacrosse is a contact sport, players are required to wear protective helmets with face masks, padded gloves, and a mouthpiece. Women's lacrosse prohibits body contact, and so players are required to wear only a mouthpiece.

Men's lacrosse. A collegiate game consists of four 15-minute quarters. Elementary and high school games consist of four 12-minute quarters. A *face-off* in the center of the field starts play each quarter, and after a goal is scored. In a face-off, two midfielders crouch down with their sticks on the ground. The official places the ball between the two sticks, and the players try to gain possession of it at the official's signal. The other midfielders can also move when play begins, but the defensemen, attackmen, and goalkeepers must remain in their own areas until the referee indicates possession. The ball is carried in the stick and passed between players in an attempt to get it in the opponent's goal. Each team must have at least three players on the offensive end of the field and four on the defensive end. Violation of this rule is called *offsides*.

Players use *stick checks* or *body checks* to get the ball away from an opponent. A stick check (also called a *crosse check*) is a tap of the stick to dislodge the ball from the opponent's crosse. In a body check, the player bumps the opponent with a hip or shoulder. Body checking is allowed only above the knees and below the neck, and from the front or side. Illegal body checks are *personal fouls*, requiring the player to leave the game for 1 to 3 minutes, depending on how serious the official considers the foul. In most cases, players must leave for 30 seconds for *technical fouls,* such as offsides or holding an opponent. A team must play short-handed while a player is suspended for either type of foul.

Women's lacrosse. A collegiate game consists of two 30-minute halves. Elementary and high school games consist of 25-minute halves. A game begins with a *draw* in the center of the field. In a draw, a player from each team holds her stick parallel to the ground about hip level. The ball is placed between the two players' crosses. At the whistle, the players pull their crosses up and away, causing the ball to fly into the air. Each player then tries to gain control of the ball for her team. There is a draw to start each half and after each goal.

Players may pass, catch, or run with the ball in the crosse. A player can gain possession of the ball by dislodging it from an opponent's crosse with a stick check. Checking involving body contact is not allowed. When a whistle blows, all players must stop in their places. When a ball is ruled out of play, the player closest to it gets possession. Each team must have at least five players on the defensive end of the field. Violation of this rule is called *offsides*.

Fouls are classed as either *major* or *minor*. The penalty for fouls is a *free position*—that is, an opportunity for the fouled player to move the ball without an opponent nearby. For major fouls, the offending player is placed 4 meters (4.4 yards) behind the fouled player. For a minor foul, the offending player is placed 4 meters off, in the direction from which she approached her opponent before committing the foul. Play then resumes with the fouled player given the ball. She may run, pass, or shoot. Major fouls include blocking, charging, dangerous shooting, misconduct, and slashing.

In the "critical scoring area"—the 15 meters (49.2 feet) surrounding the goal—players are awarded a penalty shot as the result of a major foul. In this area, the official

throws a flag to indicate the major foul, allowing the offense the opportunity to score a goal. If a goal is not scored, the official blows the whistle again and administers the penalty shot.

History. Modern lacrosse can be traced to a game played by American Indian tribes hundreds of years ago. In the 1800's, French pioneers began to play the game. In 1867, George Beers, a Canadian lacrosse player, standardized the game by setting field dimensions, limiting the number of players, and providing a set of rules.

New York University fielded the first collegiate lacrosse team in 1877. The first high schools to field teams were Phillips Academy in Andover, Massachusetts; Phillips Exeter Academy in New Hampshire; and Lawrenceville School in New Jersey, all in 1882. The first women's lacrosse game was played in 1890 in Scotland. The first women's lacrosse team was established in the United States in 1926. US Lacrosse, founded in 1998, is the governing body of the sport in the United States.

Critically reviewed by US Lacrosse

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Lactation, *lak TAY shuhn,* is the giving of milk by mammals. Soon after a female mammal gives birth to young, milk begins to be made in her mammary glands (see **Mammary glands**). Certain chemicals called *hormones* stimulate cells in the mammary glands to produce milk. Young mammals feed on milk until they are able to get food by themselves. Milk contains substances necessary for growth, such as carbohydrates, fats, and proteins. When the young stop feeding on milk, the mammary glands stop milk production.

The lactation period varies in different *species* (kinds) of mammals. For example, the lactation period lasts about 10 months in cows, and about 2 years in walruses. When the mammal becomes pregnant again, the lactation period begins once more. Lawrence C. Wit

See also **Mammal**.

Lactic acid, *LAK tihk,* is the common organic acid found in milk and other dairy foods that have turned "sour." It also occurs in sauerkraut, pickles, and beer. It exists in two forms, *D-lactic acid* and *L-lactic acid.* D-lactic acid is formed by the fermentation of sugar. L-lactic acid is found in human and animal blood. During bursts of muscular activity, L-lactic acid builds up in the muscle tissue, causing soreness and fatigue. It slowly disappears as the muscles recover.

Lactic acid is formed naturally by the fermentation of *lactose* (milk sugar). Its name comes from the Latin word *lac,* which means *milk.* Carl Scheele, a Swedish chemist, first isolated the acid from sour milk in 1780.

Commercially, the acid is made by fermenting cornstarch, molasses, potatoes, or *whey* (the watery part of milk). It is used in foods and beverages to bring out flavor. The tanning industry uses crude lactic acid to remove lime from hides. The textile industry uses it in dyeing wool. Lactic acid combines with alcohols to form *lactate esters,* used as lacquer solvents and in medicines and foods. Lactic acid is a colorless or yellowish syrupy liquid that mixes readily with water. Its chemical formula is $C_2H_4(OH)COOH$. Roger D. Barry

See also **Acid**.

Ladewig, *LAD uh wihg,* **Marion** (1914-), is recognized as the greatest woman bowler of all time. During the 1950-1951 season, she became the only bowler in history to win all-events titles on the city, state, and national levels in one season. The Bowling Writers Association of America named Ladewig Woman Bowler of the Year a record nine times, from 1950 to 1954, 1957 to 1959, and in 1963.



UPI/Bettmann

Marion Ladewig

Marion Van Oosten Ladewig was born in Grand Rapids, Michigan. She began to dominate women's bowling by about 1950. Ladewig won what is now called the Women's U.S. Open nine times between 1949 and 1963 and captured the all-events title of the Women's International Bowling Congress (WIBC) in 1950 and 1955. She won the World Invitational title in 1957, 1960, 1962, 1963, and 1964. She was elected to the WIBC Hall of Fame in 1963. Nelson Burton, Jr.

Ladies' Garment Workers' Union, International. See **Union of Needletrades, Industrial and Textile Employees**.

Ladoga, Lake. See **Lake Ladoga**.

Lady is a member of the nobility or the wife of a nobleman. In the United Kingdom, a woman who holds a title in her own right, including *marchioness, countess, viscountess,* or *baroness,* ranks as a lady. The daughter of a duke, marquess, or earl is also called a lady. The wife of a knight or baronet carries the title *lady* but loses it if her husband dies and she marries a commoner. A lady of the royal household is a *lady in waiting,* and a lord mayor's wife is a *lady mayoress.* The first ladies gained seats in the United Kingdom's House of Lords in 1958.

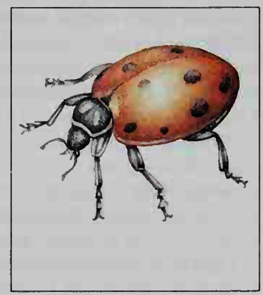
I. J. Sanders

See also **Nobility** (Privileges of the peerage).

Lady Godiva. See **Godiva, Lady**.

Ladybug, also called *ladybird* or *lady beetle,* is a small beetle with a round body shaped like half a pea. It is often bright red or yellow, with black, red, white, or yellow spots.

Ladybugs feed chiefly on aphids and scale insects. Thus, fruit growers find ladybugs helpful. In the late 1800's, the *cottony cushion scale,* a scale insect pest, almost killed California's fruit crop, and ladybugs were brought in to control the pest and save the crop. Two kinds of ladybugs harm beans, melons, squashes, and other garden plants. But the work of the beneficial



WORLD BOOK illustration by Shirley Hooper, Oxford Illustrators Limited

Ladybug

kinds of ladybugs far outweighs the damage done by the few harmful ones.

Scientific classification. Ladybugs are in the order Coleoptera and make up the family Coccinellidae. There are about 150 species in the United States. Candace Martinson

See also **Aphid; Bean beetle; Beetle** (picture); **Insect** (Insect control; pictures: Insect predators; A swarm of ladybugs).

Lady's-slipper, also called *moccasin flower,* is any one of several showy wild flowers of the orchid family. The plants grow in moist woodlands of many parts of Europe, Asia, and America. One of the petals of the flower is enlarged, forming a lip called a *labellum.* It is this structure that makes the flower resemble a slipper or moccasin.



Kitty Kohout

Lady's-slipper

The *showy lady's-slipper,* or *pink and white lady's-slipper,* is the state flower of Minnesota. Its large flowers are white, but its lip is tinged with brilliant pinkish-purple. The *yellow lady's-slipper* has beautiful, waxy, yellow flowers. Its petals twist in a spiral. The *pink lady's-slipper* is the provincial flower of Prince Edward Island. The blossoms have a velvety pink or white lip with reddish veins and greenish-brown sepals. The *small white lady's-slipper* grows in such damp places as bogs and marshy meadows.

Some tropical orchids with slipper-shaped petals are also called lady's-slippers. They grow in North and South America and in Asia.

Scientific classification. Lady's-slippers belong to the orchid family, Orchidaceae. There are four genera of lady's-slippers: *Cypripedium, Paphiopedilum, Phragmipedium,* and *Selenipedium.* J. Massey

See also **Orchid.**

Lady's-thumb. See **Smartweed.**

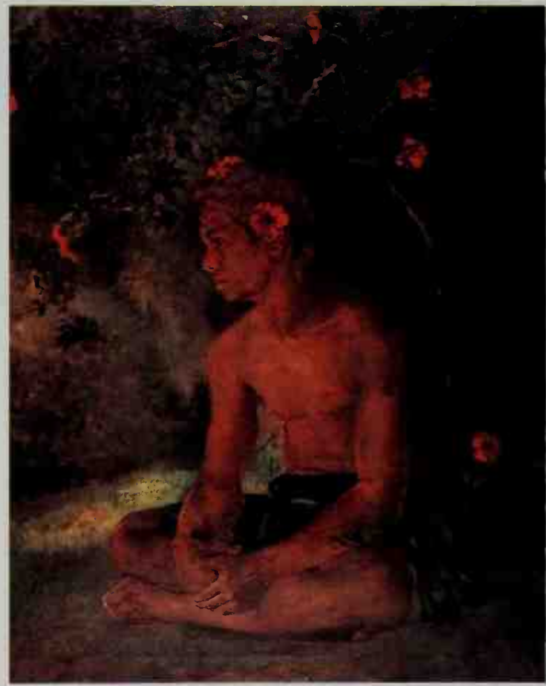
Laënnec, *lay NEHK,* **René Théophile Hyacinthe,** *ruh NAY tay aw FEEL ya SANT* (1781-1826), a French physician and surgeon, invented the stethoscope in 1816. Doctors use this instrument to listen to the sounds of the heart and other organs. Laënnec investigated diseases of the heart and the lungs, and published his conclusions in *A Treatise on Mediate Auscultation* in 1819. He died from tuberculosis, a disease on which he had become an expert. Laënnec was born in Quimper, France. See also **Stethoscope.** Matthew Ramsey

Laetrile, *LAY uh trihl,* is a drug that was popular in the 1970's as a treatment for cancer. It was the subject of a controversy among physicians, lawmakers, and patients over the right of cancer patients to receive any treatment they choose. Today, nearly all cancer specialists regard laetrile as ineffective and even dangerous.

Laetrile is extracted from apricot pits. Certain enzymes in many foods break down laetrile and release a poisonous substance called *cyanide.* Laetrile's supporters claim that the enzymes are also present in cancer cells. They believe the injection of laetrile causes cancer cells to release cyanide, which kills the cells. In their view, healthy cells are not affected because they do not contain the enzymes that break down laetrile.

In 1981, a study of laetrile by the National Cancer Institute showed that the drug did not improve the symptoms of cancer in patients. Some patients even had high levels of cyanide in their blood, a condition that can be fatal. Thomas H. Maugh II

La Farge, *luh FAHRZH,* **John** (1835-1910), was an American painter. In the 1860's, La Farge painted many landscapes and still lifes of flowers that reveal a sensitivity to delicate shadings of light and atmosphere. During the 1880's and 1890's, he painted a number of murals in a style derived from Italian Renaissance art. La Farge visited Japan in 1886 and Polynesia in 1890 and 1891. These trips inspired a series of fresh, bright water colors. La Farge made an important contribution to stained-glass design by inventing new techniques for producing colors of remarkable brilliance. He designed richly colored stained-glass windows for the mansions of wealthy clients and for churches.



Maua, Our Boatman, an oil painting on canvas; Addison Gallery of American Art, Phillips Academy, Andover, Mass.

A John La Farge portrait of a Tahitian man was painted in 1891, while the artist was visiting Polynesia. La Farge was one of the first American artists to travel to the Pacific Islands. He painted many pictures of the scenery and people he saw there.

La Farge was born in New York City. He traveled widely and was part of an intellectual circle that included the American writers Henry Adams and Henry James. La Farge also lectured and wrote on art theory. Sarah Burns

La Farge, *luh FAHRZH,* **Oliver** (1901-1963), was an American author and anthropologist. La Farge was best

known for his novels and short stories about Indian life in the American Southwest and in Central America. He also wrote studies of Indian ceremonies, customs, and languages. La Farge became a leading spokesman for the rights of Indians in the United States.

La Farge received the 1930 Pulitzer Prize for fiction for his first novel, *Laughing Boy* (1929). The book describes a Navajo Indian's problems adapting to white society. La Farge's other fiction about Indians includes the novels *Sparks Fly Upward* (1931), *The Enemy Gods* (1937), and the stories collected in *All the Young Men* (1935). One of La Farge's major anthropological works is *Tribes and Temples* (1927), written with the American anthropologist Frans Blom. The book describes the Maya Indian language.

Oliver Hazard Perry La Farge was born in New York City. During the 1920's, he made several archaeological expeditions to Arizona, Mexico, and Guatemala to study Indian culture. La Farge was also active in a number of organizations devoted to improving the life of American Indians. La Farge settled in Santa Fe, N. Mex., about 1940.

Samuel Chase Coale

La Fayette, Madame de (1634-1693), was a French novelist. *The Princess of Clèves* (1678), her masterpiece, has been called the first French psychological novel. The book is noted for its sober style and simple structure. Set in the 1500's, it is the story of a princess who is secretly in love with the Duke of Nemours, a dashing nobleman at the court of Henry II. The princess confides her secret to her adoring husband, who dies of a broken heart. She refuses to marry Nemours because she believes he is incapable of remaining faithful to her. In addition, she feels guilty about indirectly causing her husband's death, and she values emotional tranquility. Madame de La Fayette also wrote two other works, *The Princess of Montpensier* (1662), a novelette; and *Zayde* (1670), a rambling romantic tale.

Madame de La Fayette was born Marie Madelaine Pioche de La Vergne in Paris, and married François, Comte de La Fayette. Carol L. Sherman

Lafayette, Marquis de (1757-1834), was a French soldier and statesman. He fought for American independence and was a prominent leader in the early stages of the French Revolution. Lafayette's liberal beliefs cost him his fortune, his social position, and even his freedom, but his bold actions won the respect of both Americans and the French.

Lafayette was born at Chavaniac, in Haute Loire, on Sept. 6, 1757. His given and family name was Marie Joseph Paul Yves Roch Gilbert du Motier. His father died in battle when the boy was 2 years old. When his mother and grandfather died 11 years later, he inherited a great fortune. Lafayette came from a long line of soldiers and studied at the Military Academy in Versailles. At the age of 16, he married Marie Adrienne Françoise de Noailles, a daughter of one of the most influential families in France. Shortly afterward, Lafayette became a captain in the cavalry.

Service to the United States. Lafayette disliked court life. He welcomed the Revolutionary War in America as an opportunity to win military glory by fighting against Great Britain for France. He purchased a ship and landed in America in 1777 with a party of soldier-adventurers. The marquis did not impress the Continental Congress at first. But he was made a major general when he agreed to serve without pay. He joined the staff of George Washington, who developed a fatherly affection for him.



Detail of an oil painting on canvas (1799) by Charles Willson Peale; Washington, Curtis, Lee Collection, Washington and Lee University, Virginia

Marquis de Lafayette helped the American colonists in the Revolutionary War. He became a major general in their army, persuaded France to send military aid to the colonists, and assisted in the negotiations that won American independence.

Lafayette was wounded at the battle of Brandywine. At Gloucester, he defeated a small party of Hessians. This earned him the command of a division. He served at Valley Forge during part of the terrible winter of 1777-1778. Early in 1778, at Albany, N.Y., he was given command of a proposed invasion of Canada. The plan was abandoned because of troop and supply shortages. He led soldiers in the battles of Barren Hill and Monmouth, and in the campaign of Rhode Island.

In early 1779, a few months after France declared war on Britain, Lafayette returned home as a hero. He hoped to join an invasion of Britain, but it never took place. Instead, he helped persuade his government to send aid to the American colonists.

In April 1780, Lafayette returned to his post as major general in the army. Later that year, he served in the court-martial that condemned Major John André to be hanged as a spy for plotting with Benedict Arnold to surrender West Point (see **André, John**).

In 1781, Lafayette led a small American force in Virginia that evaded and then battled a larger British army under General Charles Cornwallis. After the French fleet cut off Cornwallis' escape route through the entrance of

Chesapeake Bay, Lafayette cooperated with the Comte de Rochambeau and Washington in forcing Cornwallis to surrender at Yorktown.

Lafayette had become a "hero to two worlds" when he reached France in 1782. He assisted in the negotiations that won American independence, and, at the age of 24, was raised to the rank of *marechal-de-camp* (brigadier general) in the French Army by King Louis XVI. He was now influential in both America and in France. At home in France, he cooperated closely with Benjamin Franklin, and later with Thomas Jefferson, in behalf of American interests.

Later visits to America. Lafayette revisited America in 1784 and stayed at Mount Vernon with Washington. He came again in 1824. Both times, a grateful nation received him with enthusiasm. American appreciation also took the form, in 1803, of a huge land grant to Lafayette in Louisiana. During Lafayette's last visit to America, the United States Congress voted that $200,000 and a township in Florida be given to him. Lafayette had by that time lost nearly all his French properties. Lafayette sold most of his American land.

The revolution at home. After 1782, Lafayette became absorbed in the questions of free trade, tax reform, emancipation of slaves, and religious freedom for Protestants. In the events leading to the French Revolution in 1789, he did not hesitate to sacrifice court favor and position in behalf of his liberal ideas. Lafayette was one of the first people to advocate a National Assembly, and he worked to make France a constitutional monarchy.

As commander of the new National Guard, Lafayette was one of the most powerful men in France from 1789 to 1791. But he did not believe in seizing political power for himself. He was unwilling to work with the corrupt but able Comte de Mirabeau. Queen Marie Antoinette and her court resented Lafayette. She said: "It would be better to perish than be saved by M. de Lafayette." As radicalism spread, Lafayette found it necessary to suppress crowd violence. By the summer of 1791, his popularity had gone. He found himself hated by the people, the former nobles, and the court.

After the Constitution of 1791 went into effect, Lafayette temporarily retired from active politics. When war against Britain broke out in 1792, he took charge of troops in what is now Belgium. As the military front collapsed, he unsuccessfully tried to suppress the rising tide of Jacobin radicalism at home (see **Jacobins**). However, the king and queen would not accept Lafayette's help, and the troops that he tried to turn on the Paris mob would not follow his orders. Lafayette, denounced as a traitor, fled abroad. The Austrians imprisoned Lafayette in 1792 until Napoleon's victories won his release in 1797.

Lafayette returned to France in 1800 to find that his personal fortune had been seized. He accepted Napoleon's dictatorship but rejected a seat in the senate and a diplomatic post in the United States. In 1815, after his first abdication, Napoleon returned from Elba and gave France a liberal constitution. Lafayette was elected to the Chamber of Deputies. As one of the vice presidents of the chamber, Lafayette worked for Napoleon's second abdication after the Battle of Waterloo.

Except for the reactionary periods of 1815 to 1817 and 1824 to 1827, Lafayette continued to serve in the Chamber of Deputies. He became a focal point of liberal resistance to the Bourbon kings. He upheld American interests, and fought for the cause of independence and reform in Greece, Spain, Portugal, Italy, Poland, and the South American republics.

Last years. Once more, in 1830, Lafayette became the leader of a revolution that dethroned the Bourbons. Again in command of the National Guard, he refused popular demand that he become president of the new republic. Instead, he helped make Louis Philippe the constitutional monarch of France. But Lafayette came to regret this decision and, before his death in 1834, he began to hope for a pure republic in France.

James Kirby Martin

See also **Morse, Samuel F. B.** (picture); **Washington, George** (picture: Winter at Valley Forge).

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Laffite, *lah FEET,* **Jean,** *zhahn* (1780?-1826?), also spelled *Lafitte,* was a New Orleans smuggler, pirate, and patriot. In 1810, he became chief of a band of outlaws with headquarters on Grande Terre Island in Barataria Bay in the Gulf of Mexico. With his brother Pierre, he commanded a fleet of ships and raided both Spanish and neutral vessels in the Gulf. His ships flew the flags of the Central and South American nations revolting against Spain.

In 1813, Governor William Claiborne of Louisiana offered $500 for Laffite's capture. Laffite, then at the height of his power, boldly offered $1,500 for the governor's head. All efforts to take and prosecute Laffite under the law failed.

In 1814, the British were at war with the United States. They offered Laffite $30,000, a pardon, and a naval captaincy if he would aid them in attacking New Orleans. He refused, informed the United States government of the plans, and offered the services of the Barataria smugglers to the United States. Laffite fought for General Andrew Jackson in the Battle of New Orleans on Jan. 8, 1815, and received a pardon from President James Madison.

American forces had destroyed the community at Barataria, so Laffite moved to Galveston Island. There, he established a town called Campeachy and returned to piracy. He made himself "governor" of the island. After he raided the Louisiana coast and scuttled an American ship, the United States sent an expedition in 1821 to destroy the Galveston pirate colony. Laffite quietly yielded, set fire to his town, and sailed away. Most historians believe that he died either in exile in Yucatán or in battle. Laffite was born in France. His family name was originally spelled *Lafitte.* But he spelled the name *Laffite.*

Robert C. Ritchie

See also **Louisiana** (Places to visit [Grand Isle]).

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La Follette, *luh FAHL iht,* is the name of an American family that was prominent in politics and social reform.

Robert Marion La Follette, Sr. (1855-1925), sometimes called "Battling Bob," was an American political leader and reformer. For 25 years, he was the most important figure in Wisconsin politics.


Culver Service
Robert M. La Follette, Sr.

La Follette became a lawyer in 1880 and a United States congressman in 1885. Following his defeat in the election of 1890, he practiced law in Madison, Wisconsin. He became the leader of a group within the Republican Party that opposed the conservative state leadership. Elected governor in 1900, he made Wisconsin progressive. At his urging, the legislature provided for direct primary elections, equalization of taxation, conservation of forests, and control of railroad rates.

From 1906 to 1925, La Follette was a United States senator. He advocated strict railroad regulation, lower tariffs, conservation, and better conditions for American sailors. He opposed U.S. entry into World War I (1914-1918) and U.S. membership in the League of Nations.

La Follette broke with the Republicans in 1924 when Calvin Coolidge was nominated for president. La Follette accepted the presidential nomination of a new Progressive Party, backed by independents and many labor groups. He received almost 5 million votes, but he carried only Wisconsin. La Follette was born on June 14, 1855, in Primrose, Wisconsin, near Mount Vernon. He represents Wisconsin in Statuary Hall in the United States Capitol. See **Progressive Party.**

Belle Case La Follette (1859-1931), the wife of Robert M. La Follette, Sr., was a noted journalist, speaker, and social reformer. She promoted many progressive causes and strongly supported women's rights.

In 1885, Belle La Follette became the first woman to graduate from the University of Wisconsin Law School. She did not practice law but used her legal training extensively in assisting her husband throughout his political career. In 1909, she and her husband established *La Follette's Magazine.* She edited its "Home and Education" department. Belle La Follette strongly opposed war, and she worked with the Woman's Peace Party during World War I. After the war, she helped found the Women's Committee for World Disarmament.

Many Wisconsin leaders urged Belle La Follette to run for her husband's seat in the U.S. Senate after he died in 1925. She refused to do so but helped her son Robert win election to the office. She was born on April 21, 1859, in Summit, Wisconsin, near Mauston.

Robert Marion La Follette, Jr. (1895-1953), was elected United States senator from Wisconsin after his father's death. He supported the rights of organized labor and led a movement to increase the efficiency of Congress. The Wisconsin Progressives, under La Follette's leadership, continued as an independent party until 1946, when they rejoined the Republicans. La Follette lost in a try for renomination to the Senate in the 1946 Republican primary. He was born on Feb. 6, 1895, in Madison.

Philip Fox La Follette (1897-1965), the second son of Robert La Follette, Sr., and Belle La Follette, served as governor of Wisconsin from 1931 to 1933, and again from 1935 to 1939. During his terms, legislation was passed to aid labor, farmers, and homeowners. La Follette was born on May 8, 1897, in Madison.

David P. Thelen

La Fontaine, *la fawn TEHN,* **Jean de,** *zhahn duh* (1621-1695), a French poet, is famous for his *Fables* (1668-1694). Modeled on *Aesop's fables,* La Fontaine's fables portray human behavior through animal characters. La Fontaine suggests more forcefully than Aesop that life is a jungle, reflecting life in the context of monarchy and the struggle for favor. He treated such serious subjects as power, greed, and violence with an amused, philosophical acceptance. He wrote his fables in light, natural verse. Despite their pessimism and sophistication, the *Fables* still play a large role in the education of French children. La Fontaine also wrote racy stories called *Contes (Tales)* (1664-1666).


Illustration from "The Hare and the Tortoise" based on a fable by Jean de la Fontaine, copyright © 1966 Brian Wildsmith. Used with permission of Franklin Watts, Inc.
A La Fontaine fable tells the story of the tortoise and the hare. La Fontaine adapted the fable from a collection of stories attributed to a Greek slave named Aesop. The fable describes how a slow tortoise eventually defeats a swifter hare in a race.

La Fontaine was probably born on July 8, 1621, in Château-Thierry. His friends described him as childlike, absent-minded, and ill-at-ease in society. A series of wealthy, cultured patrons supported him.

Carol L. Sherman

LaFontaine, *la fawn TEHN,* **Sir Louis Hippolyte,** *lwee ee paw LEET* (1807-1864), was a French-Canadian political leader. He worked to obtain self-government for the United Kingdom's Canadian colonies. LaFontaine supported French-Canadian patriot Louis Papineau before Papineau led a rebellion in Lower Canada in 1837. LaFontaine backed the Act of Union, a British law that united the colonies of Upper Canada and Lower Canada into a colony called the Province of Canada in 1841. In 1842 and 1843, LaFontaine and Robert Baldwin served as joint leaders of the colonial government. The colony

gained self-government in local affairs in 1848. LaFontaine and Baldwin served as joint prime ministers from 1848 to 1851. LaFontaine was born on Oct. 4, 1807, in Boucherville, Lower Canada (now Quebec). He became a baronet in 1854. J. M. Bumsted

Lagan. See Flotsam, jetsam, and lagan.

Lagerfeld, Karl (1938-), is an important German-born fashion designer. Lagerfeld designs both *couture* (high fashion) and ready-to-wear clothes for different firms as a free-lancer. During the 1980's, he became well known for his ability to design in distinctive styles for each of the fashion houses for which he worked. He was especially noted for carrying on the traditions of the famous house of Chanel while incorporating current fashion trends in his designs.

Lagerfeld was born Sept. 10, 1938, in Hamburg, Germany. He joined the staff of the French designer Pierre Balmain as a teen-ager, remaining from 1954 to 1957. Lagerfeld then served as art director for French designer Jean Patou for about five years. In about 1963, Lagerfeld began working as a free-lance designer, notably with the house of Chloé in Paris and Fendi in Rome. He became chief designer for the house of Chanel in 1983. He founded his own fashion company in 1984. He is also a noted photographer and has designed costumes for films, opera, and the theater. Jean L. Druesedow

Lagerkvist, *LAH guhr KVIHST,* **Pär Fabian,** *pair* (1891-1974), a Swedish novelist, playwright, and poet, won the Nobel Prize in literature in 1951. He is known for such plays as *The Hangman* (1933), *Midsummer Night in the Workhouse* (1941), and *Let Man Live* (1949), and such novels as *The Dwarf* (1944), *Barabbas* (1951), and *Pilgrim at Sea* (1964).

Lagerkvist's lyrical poetry has deep philosophical content. Even though his works are often set in the past, Lagerkvist wrote about the cruelty of his own time and urged people to show more humanity and tolerance. He was born on May 23, 1891, in Växjö. Niels Ingwersen

Lagerlöf, *LAH gehr LUHF,* **Selma** (1858-1940), a Swedish writer, won the 1909 Nobel Prize in literature. She is best remembered for the meaning and depth she gave to materials of folk origin. *Gösta Berling's Saga* (1891), her first novel, is her most admired book. It is a fantastic romance in loosely related episodes that deal with a swashbuckling defrocked minister and his fellow adventurers. Like much of Lagerlöf's fiction, the book is set in Värmland, the province in west-central Sweden where Lagerlöf was born.

Religion plays an important part in Lagerlöf's writing. In her novel *Jerusalem* (1901-1902), she tells of a Swedish religious group awaiting the second coming of Christ.

The Wonderful Adventures of Nils (1906-1907) is a geography textbook in fairy-tale form. It describes Sweden through the eyes of a boy traveling over the country on the back of a wild goose. The book is both factually sound and full of charm. Lagerlöf also used fairy-tale elements in *Liljecrona's Home* (1911), which is a story based on her own family in the early 1800's. The trilogy *The Ring of the Löwenskölds* (1925-1928) combines mystery, romance, and family history. It consists of *The General's Ring, Charlotte Löwensköld,* and *Anna Svärd.*

Selma Ottiliana Lovisa Lagerlöf was born on Nov. 20, 1858, in Mårbacka, her family home in Värmland. Her home is now a Swedish national shrine. Niels Ingwersen

Lagoon is a shallow body of water that is separated from the open sea. The land that separates a lagoon from the sea may be a coral reef, a sandy ridge called a *spit,* or a narrow expanse of sand called a *barrier island.* Lagoons formed by barrier islands are found along the east coast of the United States and along the Gulf of Mexico. Sand and other sediments carried in by ocean tides build up in a lagoon because it is protected from the pounding action of waves. These deposits eventually fill in the lagoon and connect the two stretches of land that it separates. See also **Atoll.** Anthony J. Lewis

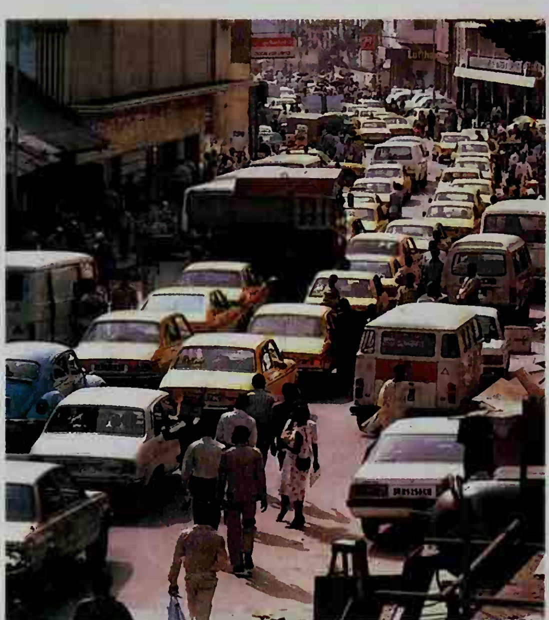
Lagos, *LAH gohs* or *LAY gahs* (pop. 1,097,000), is the chief commercial center of Nigeria. Located in southwestern Nigeria, Lagos lies partly on the African mainland and partly on four islands in the Gulf of Guinea. The Lagos metropolitan area is one of the largest in the world, with more than 14 million people. For the location of Lagos, see **Nigeria** (political map).

Lagos is Nigeria's chief port and commercial center. The city's harbor handles about 2 million tons (1.8 million metric tons) of cargo yearly. Lagos serves as the chief outlet for Nigeria's animal hides and skins, cacao, palm tree products, peanuts, and timber. The city's air, railway, road, and water transportation facilities provide links with other parts of Nigeria. An international airport operates at nearby Ikeja.

Lagos is Nigeria's main manufacturing city. Its industries include the assembly of motor vehicles and radios, brewing, food processing, oil storage, steel processing, and the production of textiles, soap, and candles.

Yoruba people lived in what is now Lagos before Portuguese explorers arrived in the late 1400's. Lagos was a major slave market until 1851, when it became a British protectorate. The United Kingdom annexed Lagos in 1861 and made it the capital of Nigeria in 1914.

In 1980, the Nigerian government began building a



© W. Campbell, Sygma

Lagos is Nigeria's chief port. Automobiles and other motor vehicles crowd the streets of this commercial center.

new city called Abuja near the center of the country to replace Lagos as the capital. In December 1991, Abuja became Nigeria's official capital. By the late 1990's, most government ministries had moved their headquarters to Abuja. Ebere Onwudiwe

See also **Abuja**; **Nigeria** (picture).

Lagrange, *luh GRAYNJ* or *lah GRAHNZH,* **Joseph-Louis** (1736-1813), was a French mathematician. He wrote on algebra, calculus, and number theory. His most famous work, *Analytical Mechanics* (1788), is a purely algebraic study of forces and motions, including the orbits of planets, the flow of liquids, and the vibration of strings.

Lagrange was born on Jan. 25, 1736, in Turin, Italy. At age 19, he became a mathematics professor at Turin's royal artillery school. He later was a mathematician at the court of Frederick the Great of Prussia. Lagrange also taught mathematics in Paris. Judith V. Grabiner

See also **Number theory**.

La Guardia, *luh GWAHR dee uh,* **Fiorello Henry,** *FEE uh REHL oh* (1882-1947), gained national fame as the mayor of New York City from 1934 to 1945. A liberal Republican, La Guardia became known as a progressive reformer who was sensitive to the needs of ordinary citizens. As mayor, he cooperated with Democratic President Franklin D. Roosevelt's economic recovery program, known as the *New Deal.* La Guardia's urban reform programs included slum clearance; school, park, and street development; and airport construction.



United Press Int.

Fiorello La Guardia

La Guardia was born on Dec. 11, 1882, in New York City. He graduated from the New York University Law School in 1910. La Guardia served in the United States House of Representatives from 1917 to 1921 and 1923 to 1932. In Congress, he co-sponsored the Norris-La Guardia Act of 1932, which protected the rights of striking workers (see **Norris-La Guardia Act**). David E. Kyvig

Lahore, *luh HOHR* (pop. 2,952,689), is the second largest city in Pakistan. Only Karachi has more people. Lahore is the capital of Punjab, a province in northeast Pakistan (see **Pakistan** [political map]). The city is a center of weaving, milling, and other industries. Lahore is also an educational center. It has a museum and several schools, including Punjab University.

The oldest part of Lahore is at least a thousand years old. It has many landmarks that recall the glories of the Mughal period in India. Lahore was the capital of the Sikh Empire before the British took it over, and the city has many historic Sikh shrines. Many houses have balconies and lattice windows decorated with carved woodwork. Lahore has a magnificent Muslim mosque, a mausoleum, and a royal palace. Riffat Sardar

Laird, Melvin Robert (1922-), served as secretary of defense under President Richard M. Nixon from January 1969 to January 1973. In June 1973, he became counselor to the president for domestic affairs. Laird left in January 1974 to become a senior counselor of the Reader's Digest Association. Laird had previously spent 16 years in the United States House of Representatives, where he was an influential Republican Party leader.

Laird was elected to the U.S. House in 1952 after six years in the Wisconsin state Senate. As a member of the appropriations committee, he specialized in defense and health programs. Laird was chairman of the platform committee at the 1964 Republican convention. He was chairman of the House Republican Conference from 1965 through 1968.

As secretary of defense, Laird became noted for his support of U.S. military superiority in order to negotiate from strength with the Soviet Union. He also supported the establishment of a volunteer army.

Laird was born on Sept. 1, 1922, in Omaha, Nebraska. He grew up in Marshfield, Wisconsin. He graduated from Carleton College. Laird served in the United States Navy during World War II (1939-1945). David S. Broder

Laissez faire, *LEHS ay FAIR,* is a theory of economic policy which states that government generally should not interfere with decisions made in an open, competitive market. These decisions include setting prices and wages and making other choices that affect the sale of goods and services. According to laissez faire, workers are most productive and a nation's economy functions most efficiently when people can pursue their private economic interest in relative freedom.

Laissez faire is a French phrase meaning *allow to do.* It was first made popular by a group of French writers called *physiocrats* between the 1750's and 1780's. At that time, the governments of many European countries practiced a set of policies known as *mercantilism.* Mercantilism involved strict regulation of agriculture, industry, and trade. Its chief goal was to ensure that exports exceeded imports. The physiocrats insisted that such restrictions actually hindered the growth of trade.

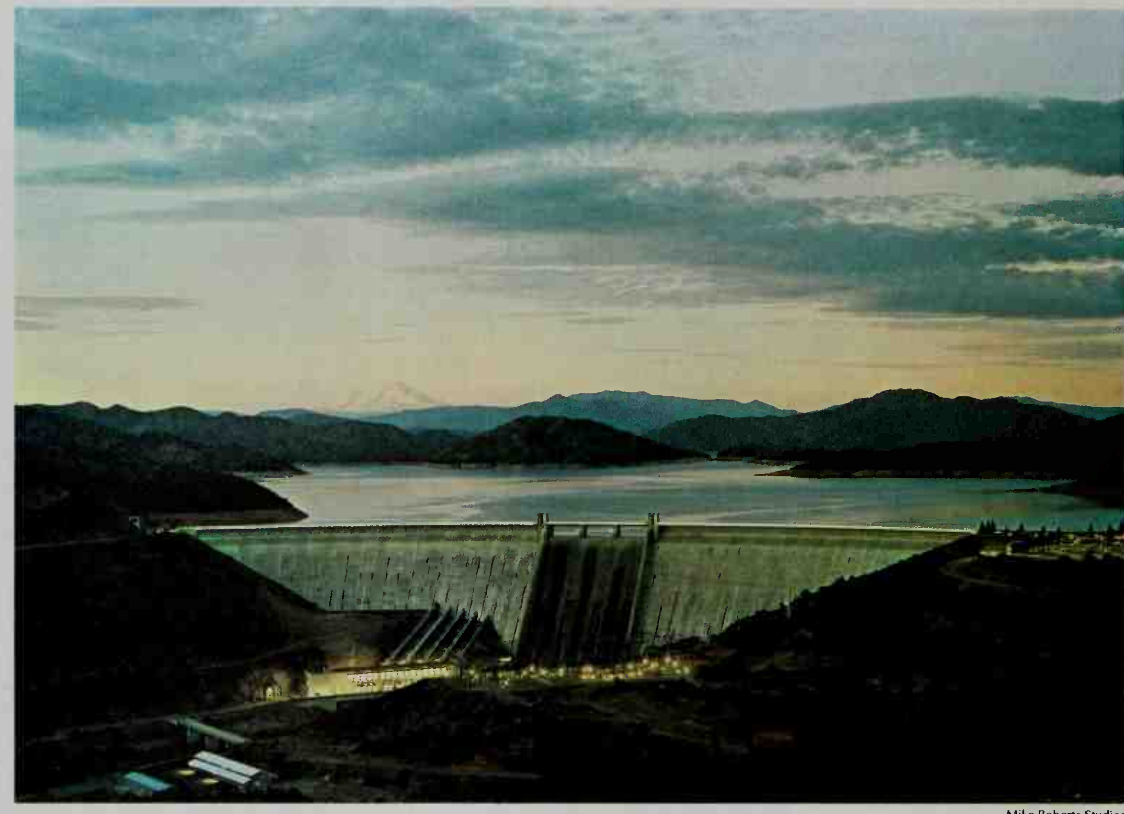
A group of thinkers called the *British classical school,* led by the Scottish economist Adam Smith, gave the laissez-faire principle its fullest explanation and defense between the 1770's and the 1840's. Their support came at a time when laissez faire suited the needs of a rapidly developing industrial economy. The classical economists started from the assumption that individuals are motivated by self-interest. They maintained that people serve their own interests best when they provide the goods and services most wanted by others. Individuals who are free to operate in an open, competitive market automatically promote prosperity for all. Thus, the government should have little to do with the economy.

The theory of laissez faire greatly influenced economic thought and action during the early and mid-1800's. Later, however, critics charged that laissez faire failed to solve many economic and social problems that had arisen. Gradually, the governments of industrialized nations started to regulate economic activities more closely. They also began to pass laws aimed at relieving such social problems as poverty and unemployment.

Some modern economists call for a return to laissez-faire policies. The American economist Milton Friedman ranks as one of the leading supporters of such policies.

William D. G. Hunter

See also **Capitalism**; **Economics** (Capitalism; Early theories); **Freedom** (Economic freedom); **Physiocrats**; **Smith, Adam**.



Mike Roberts Studios

Different kinds of lakes include artificial lakes, glacial lakes, and volcanic lakes. Artificial lakes are created by blocking streams to store up water for irrigation, electric power, and recreation. Shasta Lake, *above,* was formed when Shasta Dam was built on the Sacramento River in California.

Lake is a body of water surrounded by land. Lakes may be found in all parts of the world. Some large bodies of water commonly known as seas are really lakes. These include the Dead Sea, the Sea of Galilee, and the Caspian Sea. Some lakes lie near the highest regions of the earth, and others are far below sea level. Lake Titicaca, in South America, is 12,507 feet (3,812 meters) above sea level. The Dead Sea, between Israel and Jordan, lies about 1,310 feet (399 meters) below sea level. The word *lake* comes from a Greek word meaning *hole* or *pond.*

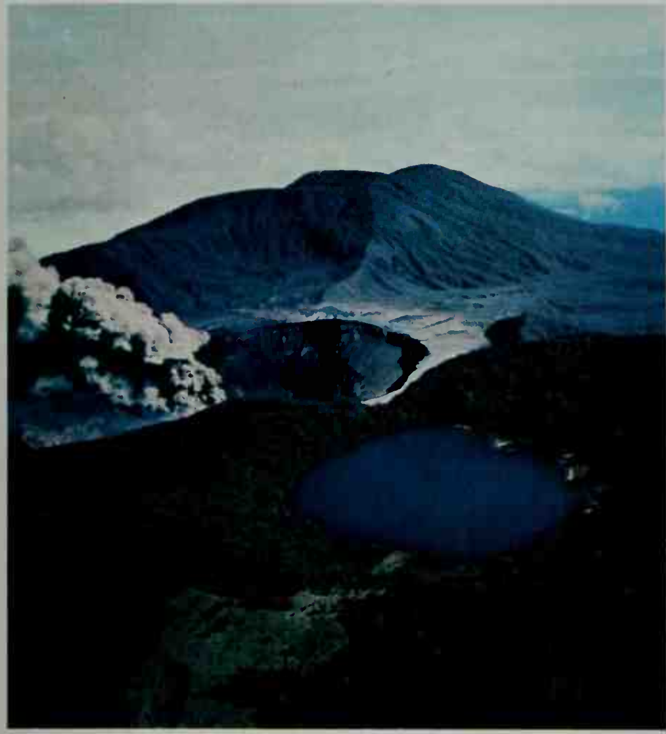
The life of a lake

How lakes are formed. The greatest number of lakes lie in regions that were once covered by glaciers. In mountainous regions, glaciers carved deep valleys as they traveled. The basins they carved then filled with water to form lakes. In nonmountainous regions of North America and northern Europe, glaciers gouged hollows in the land and deposited rocks and earth as they melted. Many lakes formed in these hollows and in the uneven land created by glacial deposits. The action of glaciers explains why there are more lakes in the northern part of the United States than in the southern part. Minnesota has about 11,000 lakes formed by the action of glaciers. The Great Lakes were formed partly by glacial action.

Other areas that abound in lakes are regions lying on limestone bedrock, such as the Florida peninsula in the Southern United States. More than 1,400 lakes and ponds lie in Lake County, Florida. In a limestone region, underground water slowly dissolves the limestone rock. This action begins in cracks in the rock and continues until the surface collapses, forming a pit known as a *sinkhole.* The sinkhole may then fill with water and become a lake or a pond.

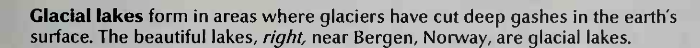
Sinkholes may be 60 feet (18 meters) or more deep. They sometimes lie in the course of a fast-flowing underground stream. In such cases, the sinkhole fills quickly, forming a beautiful pool of crystal-clear water. The uplands region of northern Florida has many of these "springs," as they are known locally. The largest and best known is Silver Springs.

Lakes may also form in a number of other ways. The natural collection of rainwater in the craters of extinct volcanoes can create lakes. Crater Lake in Oregon was formed in this manner. Lake basins can be created by movements in the earth's crust known as *faulting.* Lake Baikal in Russia, the world's deepest lake, was formed this way. Lakes may appear when rivers deposit silt until the natural outlet to the sea is closed, and the water backs up. Dam construction creates great artificial lakes that are called *reservoirs.* The lake behind the dam in Kariba Gorge, on Africa's Zambezi River, is more than 175 miles (282 kilometers) long.



Thomas Hollyman, Photo Researchers

Volcanic lakes form when water collects in the craters of extinct volcanoes. Poás Volcano in Costa Rica, *above,* contains a volcanic lake in one of its craters.



Glacial lakes form in areas where glaciers have cut deep gashes in the earth's surface. The beautiful lakes, *right,* near Bergen, Norway, are glacial lakes.



J. L. Stage, Photo Researchers

How lakes are fed. Rivers and mountain streams feed some lakes. Other lakes do not appear to have any water coming into them. They are actually fed by underground springs or streams. Still other lakes have inlets but no outlets. For example, the Great Salt Lake in Utah does not have any streams running out of it.

How lakes disappear. The lakes that now exist will probably disappear in time. Some lakes dry up because of a change in climate or because of a change in the course of the waters that feed them. A bursting volcano or earthquake may change the surface of the surrounding region and cause lakes to disappear. In addition, lakes may drain into other bodies of water and vanish.

Ground water fills the sinkholes in limestone areas. A long drought in such areas can completely dry up lakes and ponds in sinkholes. A seepage outlet in a sinkhole may also cause a lake to disappear by draining the water into an underground cavern. Many low-lying regions on the earth's surface are the basins of lakes that no longer exist. Small lakes can be filled in by deposits of mud, sand, and silt. These materials may form excellent soils.

The lake habitat. Lakes create little worlds of their own. Water plants live under the surface of lakes. Some of the plants are attached to the lake bottom, and others float free. This vegetation provides food for water creatures such as water insects, snails, turtles, and fish. Lakes are also a habitat for waterfowl such as ducks, geese, swans, flamingos, egrets, cranes, and others. Land animals use lakes for drinking water. They also obtain food from lakes.

The importance of lakes

Climate. The presence of large lakes in a region greatly influences the lives of the people living nearby. Lakes affect weather conditions over a large area. In summer, a lake never gets as warm as the surrounding land. Thus, breezes blowing over the water are cooled. In winter, a lake does not cool off as fast as the surrounding land, and may cause the climate to be warmer.

Warm winds blowing off a lake in autumn make it possible for certain crops to grow especially well. The warming influence of Lake Ontario in autumn extends the growing season of southern Ontario, making it possible to raise fruits and corn. The great fruit belt of Michigan, along the east shore of Lake Michigan, depends partly on winds off the lake. Cool spring winds delay the blossoming of the fruit trees until the danger of a killing frost has passed. Warm winds in autumn allow the fruit crops to be harvested before the frost strikes. The thousands of lakes in central Florida have an important effect on the location of the state's citrus-fruit industry. Careful studies have shown that these lakes help reduce the damaging effects of cold spells that might cause great loss to fruitgrowers.

World's largest natural lakes

Lake	Location	Area In sq. mi.	Area In km²	Length In mi.	Length In km	Maximum width In mi.	Maximum width In km	Maximum depth In ft.	Maximum depth In m
Caspian Sea*	Kazakhstan-Turkmenistan-Iran-Azerbaijan-Russia	143,250	371,000	746	1,201	300	483	3,264	995
Lake Superior	Canada-United States	31,700	82,103	350	563	160	257	1,333	406
Lake Victoria	Kenya-Tanzania-Uganda	26,828	69,484	260	418	150	241	270	82
Lake Huron	Canada-United States	23,000	59,600	206	332	183	295	750	229
Lake Michigan	United States	22,300	57,757	307	494	118	190	923	281
Lake Tanganyika	Burundi-Tanzania-Zambia-Congo (Kinshasa)	12,700	32,893	420	676	30	48	4,708	1,435
Lake Baikal	Russia	12,162	31,499	395	636	49	79	5,315	1,620
Great Bear Lake	Canada	12,096	31,328	211	340	110	177	1,299	396
Lake Nyasa	Tanzania-Mozambique-Malawi	11,100	28,749	350	563	50	80	2,300	701
Aral Sea*	Kazakhstan-Uzbekistan	11,000	28,500	180	290	95	155	115	35

*Saltwater.

Travel and trade routes. The growth of travel and commerce on the Great Lakes provides a typical example of people's use of lakes. The early explorers of North America used lakes and their connecting rivers as their chief travel routes. Some of these explorers paddled canoes up the St. Lawrence River to the Great Lakes.

Steamboats took the place of canoes as the civilization of white people expanded. Today, freighters, tugboats, and barges work their way along inland navigation routes on the Great Lakes, carrying raw materials to the industrial cities that are located along the lakes. Products carried on the Great Lakes include coal, iron ore, and grain.

Irrigation. Lakes provide an important source of water for irrigation. Water may be fed from the lakes to farmers' fields by ditches or canals, or it may be pumped into an overhead system of sprinklers. People have built huge dams on rivers in desert areas to create reservoirs of water for irrigation. The Egyptians built the Aswan High Dam on the Nile River partly for this purpose. The dams on the Indus River provide water to irrigate 36 $\frac{1}{2}$ million acres (14.8 million hectares) of desert land. These irrigated regions, which lie mainly in Pakistan, supply food for millions of people.

Water supply has been a serious problem ever since people started to live in towns and cities. Lakes offered a natural reservoir of water for early communities. However, most cities today have outgrown such natural supplies, and people have built huge storage dams to provide additional water. The reservoirs formed by these dams sometimes lie far away from the city. For example, New York City uses water from the Catskill Mountains, which are located more than 100 miles (160 kilometers) away.

Hydroelectric power. Lakes created as storage reservoirs can be used to generate electric power. To produce electric power, hydroelectric power plants make use of the force of water falling from the dam to the river below.

Recreation. People use lakes for a variety of recreational activities. They flock to lakes to enjoy fishing, boating, swimming, water-skiing, and ice skating. In such states as Florida, the freshwater recreational industry provides millions of dollars of income every year.

James C. Walters

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Lake Edward
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Lake Volta

Asia and Australia

Aral Sea
Caspian Sea
Dead Sea
Galilee, Sea of
Lake Baikal
Lake Balkhash
Lake Eyre
Lake Torrens

Canada

Great Bear Lake
Great Lakes
Great Slave Lake
Lake Agassiz
Lake Athabasca
Lake Champlain
Lake Erie
Lake Huron
Lake Louise
Lake Manitoba
Lake of the Woods
Lake Ontario
Lake Saint Clair
Lake Superior
Lake Winnipeg
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Rainy Lake
Reindeer Lake

Central America and South America

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Lake Nicaragua
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Lake Constance
Lake Geneva
Lake Ilmen
Lake Ladoga
Lake Maggiore
Lake of Lucerne
Lake Onega
Lake Peipus
Lakes of Killarney
Loch Lomond
Lough Neagh
Windermere

United States

Crater Lake
Finger Lakes
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Lake Tahoe
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Lake Winnebago
Rainy Lake
Salton Sea

Other related articles

Lagoon
Lake Xochimilco
Limnology
Oxbow lake
Pond
Water (Sources of supply)

Lake is a coloring substance that will not wash out. It is formed by combining *mordants* with dyestuffs. Mordants are usually metallic salts. These react chemically with soluble dyes to form the insoluble, colored lakes. See **Mordant**.

There are two kinds of lakes. One is produced from natural dyes, and the other is made from coal-tar dyes or other synthetic dyes. Natural lakes include carmine, madder, and the Vienna dyes fixed with aluminum or tin. Carmine lake is prepared from the coloring matter of cochineal insects. It is a beautiful scarlet color. Madder lake is red. It comes from the root of the madder plant. Vienna lake is a violet color and comes from brazilwood. Synthetic dyes can give a much wider range of color. These dyes are produced at a much lower cost. They have almost entirely replaced the natural lakes.

Lakes have many uses. They are used in calico printing, silk dyeing, for decorative work, color printing, and as pigments in paints and lacquers. Howard L. Needles

Lake Agassiz, *AG uh SEE,* was the largest glacial lake in North America. It covered much of present-day Manitoba and northwestern Ontario, and portions of Saskatchewan, North Dakota, and Minnesota. The lake was created late in the Pleistocene Epoch, a time marked by a succession of ice ages that ended about 11,500 years ago (see **Ice age**). As the Laurentide Ice Sheet, which covered the area, moved northeastward, it left a large, shallow basin behind it. Melting ice and river water filled the basin to form Lake Agassiz. The lake reached its maximum area of about 135,100 square miles (350,000 square kilometers) between 7900 B.C. and 7500 B.C. When ice continued to melt at the lake's north and east shores, the waters drained away toward Hudson Bay. Several smaller lakes, including Winnipeg, Winnipegosis, and Manitoba, were left in the deeper part of the area. The plain of Canada's Red River, one of the world's most fertile wheat-growing regions, is the former lake bed. See also **Red River of the North**. John S. Brierley

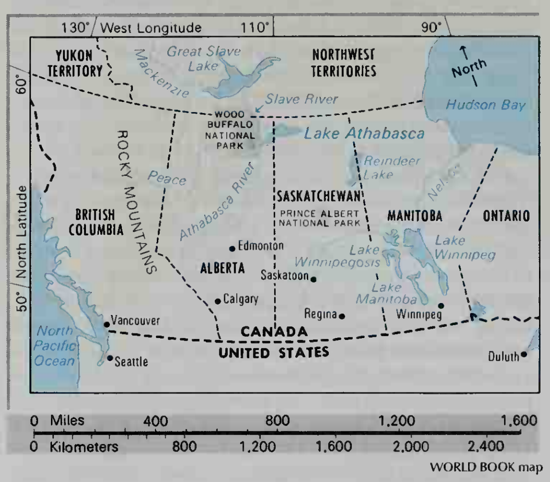
Lake Albano, *al BAHN oh,* lies in the crater of an extinct volcano in west-central Italy. For location, see **Italy** (terrain map). Ancient Romans vacationed at the lake. The pope, the head of the Roman Catholic Church, lives during the summer in Castel Gondolfo, a town along the lake. Howell C. Lloyd

Lake Albert, also called Albert Nyanza, is one of the sources of the Nile River. It lies between Congo (Kinshasa) and Uganda (see **Nile River** [map]). It covers about 1,640 square miles (4,248 square kilometers). It is about 100 miles (160 kilometers) long and about 20 miles (32 kilometers) wide. Lake Edward flows into Lake Albert from the south through the Semliki River. Waters from Lake Victoria reach Lake Albert by way of the Victoria Nile River after flowing over Murchison Falls, also known as Kabalega Falls. The waters of Lake Albert drain north and form the Albert Nile. Lake Albert was named for the husband of Queen Victoria of the United Kingdom. See **Baker, Sir Samuel White**. Michael L. McNulty

Lake Athabasca, *ATH uh BAS kuh,* is the fourth largest lake entirely within Canada's borders. Its area is 3,064 square miles (7,935 square kilometers). About two-thirds of the lake lies in Saskatchewan, and the rest in Alberta. The Athabasca River flows into the southwestern tip of the lake, and the Slave River discharges from the same tip. During the breeding season, many Canadian geese nest along Lake Athabasca's low, sandy shores. The south-central shore has a large sand dune area. Wood Buffalo National Park borders the lake. G. Peter Kershaw

Lake Baikal, *by KAHL,* also spelled *Lake Baykal,* is the deepest lake in the world. It also contains more water than any other freshwater lake. Lake Baikal lies in southeastern Siberia, a part of Russia. The lake is 5,315 feet (1,620 meters) deep at its deepest point and consists of more than 20 percent of the world's unfrozen fresh water. Lake Baikal covers an area of 12,162 square miles (31,499 square kilometers). It measures about 395 miles (636 kilometers) long and about 49 miles (79 kilometers) wide at its widest point. In 1967, Lake Baikal and the surrounding area were established as a national park.

Lake Athabasca

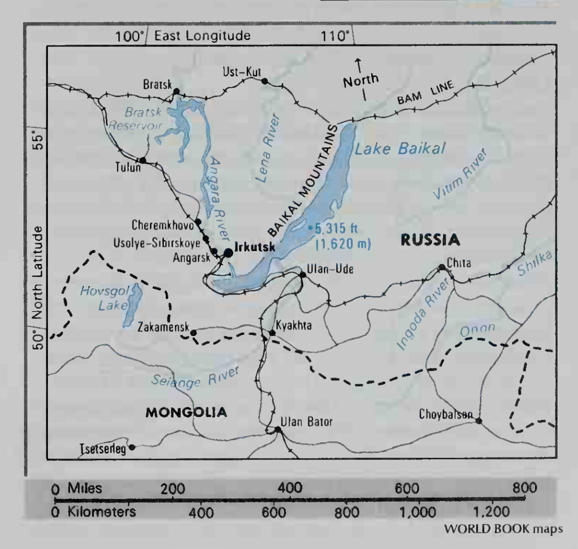


WORLD BOOK map

Lake Baikal
Area: 12,162 sq. mi. (31,499 km²)
Elevation: 1,493 ft. (455 m) above sea level
Deepest Point: • 5,315 ft. (1,620 m)

Road Railroad





WORLD BOOK maps

Lake Baikal is one of the world's oldest lakes. It was formed about 25 million years ago by movements of the earth's crust. More than 1,500 kinds of wildlife are found only in Lake Baikal or the nearby area. They include the golomyanka and other kinds of fish. The Baikal seal—found only in the lake—is one of the few kinds of seals that live in bodies of fresh water.

The large volume of water in Lake Baikal affects the weather in the surrounding area. For example, the area nearest the lake has temperatures several degrees warmer in winter, and cooler in summer, than places farther inland. The lake's surface is usually frozen from January to May. Although 336 rivers flow into Lake Baikal, only one, the Angara, empties out of it.

The chief products of the Lake Baikal region include cellulose, paper, timber, and fish. The lake, especially its southwest section, suffers from pollution. Hydroelectric dams on the Angara River supply power to the city of Irkutsk and other nearby communities. George J. Demko

Lake Balkhash, *bahl KAHSH,* is a large lake in the southeastern part of Kazakhstan. For location, see **Kazakhstan** (map). The lake lies 1,122 feet (342 meters) above sea level and has an area of 6,670 square miles (17,275 square kilometers). It is only 6 miles (10 kilometers) wide at the eastern end and 54 miles (87 kilometers) wide at the western end. The water in the western part of the lake is fresh because of the inflow of the Ili River, but there is salt water in the eastern part. Several rivers empty into Lake Balkhash, but the lake has no outlet. Ice covers the lake from November to April. Leslie Dienes

Lake Bangweulu, BANG *wee OO loo,* is a shallow depression about 50 miles (80 kilometers) long and 30 miles (48 kilometers) wide in northern Zambia (formerly Northern Rhodesia). For location, see **Zambia** (map). Much of the area to the south and southeast is swamp, which floods in the rainy season. The normal size of the lake is about 1,900 square miles (4,920 square kilometers), but the floodwaters increase it to about 4,500 square miles (11,700 square kilometers).

The Luapula River, which flows out of the southern end of Lake Bangweulu, is one of the headstreams of the Congo River. David Livingstone, the British explorer, reached Lake Bangweulu in 1868. Livingstone died near the lake in 1873. Michael L. McNulty

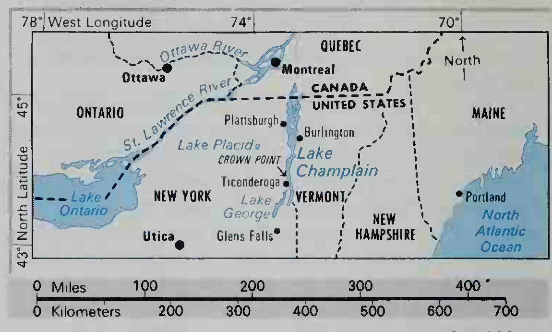
See also **Stanley and Livingstone**.

Lake Baykal. See **Lake Baikal**.

Lake Chad is a large lake in north-central Africa. Most of it lies within Chad, and the rest lies in Nigeria, Cameroon, and Niger. For location, see **Chad** (map). Scientists think the average size of Lake Chad expands and contracts in 10-year cycles, but its overall size has shrunk for many years. It now has an area of about 6,300 square miles (16,300 square kilometers). Lake Chad's shoreline changes in relation to the quantity of water that rivers pour into the lake and the rate of water evaporation. The lake is much larger in rainy seasons than in dry seasons. Lake Chad is seldom deeper than 22 feet (7 meters) because its basin is so shallow that water overflows into the countryside. Many islands rise from the lake's surface, which is covered by a tangle of grasses and weeds. This matted surface has caused many people to refer to the lake as "a drowned prairie." Michael L. McNulty

Lake Champlain, *sham PLAYN,* is a long, narrow lake on the border between New York and Vermont, with its northern tip extending into Quebec. The lake covers 490 square miles (1,270 square kilometers). Almost two-thirds of the lake lies in Vermont. Lake Champlain is 107 miles (172 kilometers) long and from less than 1 mile (1.6 kilometers) to 10 miles (16 kilometers) wide. Its maximum depth is 400 feet (122 meters). It was named for the French explorer Samuel de Champlain, who in 1609 became the first European to reach it (see **Champlain, Samuel de**). Several naval battles were fought on the lake during the Revolutionary War in America (1775-1783) and the War of 1812. Andrew R. Bodman

Lake Champlain



WORLD BOOK map

Lake Charles (pop. 71,757; met. area pop. 183,577) is an industrial and shipping center in southwestern Louisiana. Lake Charles lies on a lake of the same name and on the Calcasieu River. A channel links the city and the Gulf of Mexico, which lies about 34 miles (55 kilometers) to the south (see **Louisiana** [political map]). The center of Lake Charles, which includes City Hall and a civic center, lies along the lake. McNeese State University is in Lake Charles.

Atakapa Indians once lived in what is now the Lake Charles area. In the early 1780's, Charles Sallier became the first white person to settle within the present city limits. The settlement around the lake came to be known as Charlestown (or Charleston) and was renamed Lake Charles in 1867.

Oil and natural gas were discovered in the Lake Charles area in the late 1800's, and the channel to the Gulf of Mexico was opened in 1926. Petroleum, chemical, and shipping industries were developed. Aircraft maintenance, offshore oil and gas industries, and riverboat casino gambling are also some of the city's industries. The city's products include chemicals, refined petroleum, plastics, and synthetic rubber. Lake Charles is the *parish* (county) seat of Calcasieu Parish and has a mayor-council form of government. James C. "Jim" Beam

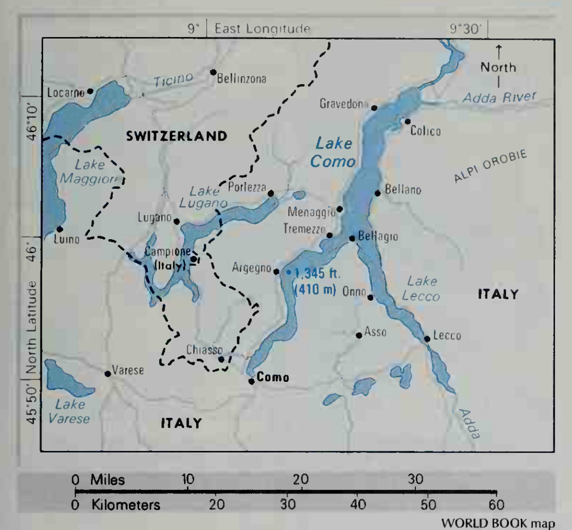
Lake Clark National Park is in southern Alaska, across Cook Inlet from Anchorage. For location, see **Alaska** (political map). The park's features include lakes, rivers, valleys, and mountains—including two active volcanoes. Lake Clark, in the park, provides an important breeding ground for red salmon. Wildlife in the park includes bald eagles, peregrine falcons, bears, caribou, Dall's sheep, foxes, lynx, minks, otters, and wolves. The park attracts several thousand visitors a year, but much of it is unexplored. The area was established as a national monument in 1978 and became a national park in

Lake Como

Area: 56 sq. mi. (145 km²)
Elevation: 653 ft. (199 m) above sea level
Deepest Point: • 1,345 ft. (410 m)

—— Road





WORLD BOOK map

1980. For its area, see **National Park System** (table: National parks). Critically reviewed by the National Park Service

Lake Como is one of the most beautiful sites in Europe. It lies at the foot of the Alps in the province of Lombardy in northern Italy. It is called *Lago di Como* in Italian. The lake covers an area of 56 square miles (145 square kilometers). It is a natural widening of the Adda River. Lake Como's shores are lined with handsome summer homes, fine gardens, and fertile vineyards. Thousands of tourists visit Como, the chief town on the lake, each year. Anthony James Joes

Lake Constance, called *Bodensee* in German, lies in a basin of the upper Rhine River Valley at the eastern end of the Swiss Plateau, where the borders of Germany, Switzerland, and Austria meet (see **Switzerland** [terrain map]). The lake, of glacial origin, covers 208 square miles (539 square kilometers). It is about 42 miles (68 kilometers) long and 8 miles (13 kilometers) wide.

Since ancient times, people have lived and traded goods along the lake. Today, many towns and villages line its shores. Their economies are based on agriculture, light industry, and tourism. The major towns include Konstanz and Friedrichshafen, Germany; Rorschach, Switzerland; and Bregenz, Austria.
Howell C. Lloyd

Lake dwelling. Early peoples in Europe sometimes built dwelling places in lakes or at the edges of lakes or creeks. Scientists have come to call these houses lake dwellings. The people placed their houses on wooden platforms which stood on *piles,* or posts. They drove the foundations deep into the mud, and often held them steady by stones stacked around their bases. Some houses were clustered in villages.

The Greek historian Herodotus, who lived in the 400's B.C., made the first known mention of lake dwellings. He wrote of a lake-dwelling community located in Macedonia. Archaeologists first discovered the remains of prehistoric lake houses in 1853, in a lake near Zurich, Switzerland. The relics had been preserved by the waters of the lake and by the mud of the lake bottom. Since 1853, scientists have found the ruins of lake dwellings in various parts of Switzerland and beside lakes and streams of other countries in Europe. They have found weapons made of bone, stone, and metal, as well as crude pottery bowls and dishes, near the sites of the dwellings. Some of the pottery vessels still contained cereal grains and fruits. Scientists believe the pottery and weapons belonged to the owners of the dwellings.

Archaeologists have used the ruins of lake dwellings to learn about the early people who built the wooden houses. The scientists believe that there was a sequence, or series, of lake dwellings built in Europe. The first, and finest, of these dwellings were put up about 5,000 years ago, during the Neolithic period, or New Stone Age. Later peoples built lake dwellings during the Bronze and Iron ages.

The early people of Scotland and Ireland built primitive dwellings called *crannogs* in lakes and bogs. The name comes from the Celtic word *crann,* which means *tree.* These rude houses were artificial islands of wood, stones, and earth. Wooden stakes driven deep into the mud held the islands in place.

People in some parts of the world still live in wooden houses built on piles over the waters of a lake or bay. Some people in New Guinea, the Malay Archipelago, and Venezuela build lake dwellings for protection against enemies and floods. Brian M. Fagan

Lake Edward is one of the sources of the Nile River. It lies in the Rift Valley of central Africa between Uganda and Congo (Kinshasa). Most of the lake is in Congo. For location, see **Nile River** (map). Lake Edward is about 40 miles (64 kilometers) long and 32 miles (51 kilometers) wide, and it covers 830 square miles (2,150 square kilometers). Fish life is abundant in the lake. The Semliki River flows north from Lake Edward into Lake Albert in a valley west of the Ruwenzori Range (see **Lake Albert**).

The explorer Henry M. Stanley reached the lake in 1889. He named it for the Prince of Wales, later King Edward VII. Lake Edward's original name was Albert Edward Nyanza. *Nyanza* means *lake* in the Bantu language.
Michael L. McNulty

Lake Erie, on the border between the United States and Canada, is the farthest south of the five Great Lakes of North America (see **Great Lakes**). It is bordered by the U.S. states of New York, Pennsylvania, Ohio, and Michigan, and the Canadian province of Ontario.

Lake Erie is 241 miles (388 kilometers) long and ranges from 38 to 57 miles (61 to 92 kilometers) in width. With an area of 9,910 square miles (25,670 square kilometers), it is the fourth largest of the five Great Lakes. Only Lake Ontario is smaller. Lake Erie lies 569 feet (173 meters) above sea level. A shallow lake, it has an average depth of only 62 feet (19 meters) and is 210 feet (64 meters) deep at its deepest point. The lake is quickly stirred by storms and often has violent waves. French explorers called Lake Erie *Lac du Chat* (Lake of the Cat) because the Iroquois Indians called the tribe of Indians living near the lake *Erieehronons.* This Iroquois word probably meant *the people of the panther.*

Lake Erie lies between Lake Huron and Lake Ontario. Lake Erie receives water from Lake Huron through the St. Clair River, Lake St. Clair, and the Detroit River. Water from Lake Erie flows into Lake Ontario by way of the Niagara River. Lake Ontario lies 326 feet (99 meters) below Lake Erie. As a result, about halfway along its course, the Niagara River plunges over two steep waterfalls—the famous Niagara Falls. The falls make the river unnavigable. But the artificially created Welland Ship Canal, about 10 miles (16 kilometers) west of the river, provides passage between Lakes Erie and Ontario (see **Welland Ship Canal**). The New York State Barge Canal System joins Lake Erie with the Hudson River and the Atlantic Ocean (see **New York State Barge Canal System**).

The main ports on Lake Erie are located at Toledo, Sandusky, Cleveland, Ashtabula, and Conneaut, all in Ohio; Erie, Pa., and Buffalo, N.Y. Iron ore and taconite from Minnesota and limestone from Michigan are shipped on Lake Erie to Ohio ports for use in steel mills in Ohio and in Pittsburgh, Pa. Toledo is a busy coal-shipping port. Buffalo is the most important grain-shipping port on the lake.

Since the mid-1800's, industries, cities, and farms have polluted Lake Erie by dumping waste into it. By the late 1960's, the lake was so heavily polluted that a large number of fish had died, and the water had become unsafe for swimming. In 1972, the Canadian and United States governments agreed to clean up the lake. Since then, the quality of Lake Erie's water has improved greatly, the supply of fish has increased, and the danger of swimming has decreased. A. P. Lino Grima

Lake Eyre, *air,* is a large, shallow body of salt water in South Australia. Most of the time, Lake Eyre is a dry bed of salt. It fills with water only after heavy rains. The northern part is 90 miles (145 kilometers) long and 40 miles (64 kilometers) wide, and the southern part 38 miles (61 kilometers) long and 16 miles (26 kilometers) wide. Lake Eyre covers 3,700 square miles (9,583 square kilometers). D. N. Jeans

Lake Forest College is a private, coeducational liberal arts college in Lake Forest, Ill. The college offers a traditional arts and sciences course of study. Students may also pursue internships, off-campus study programs, and majors combining different fields of study. The college was founded in 1857.

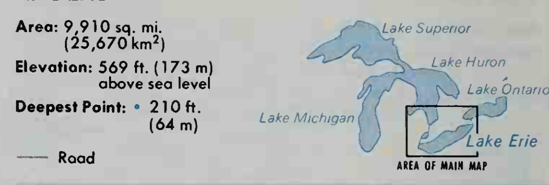
Critically reviewed by Lake Forest College

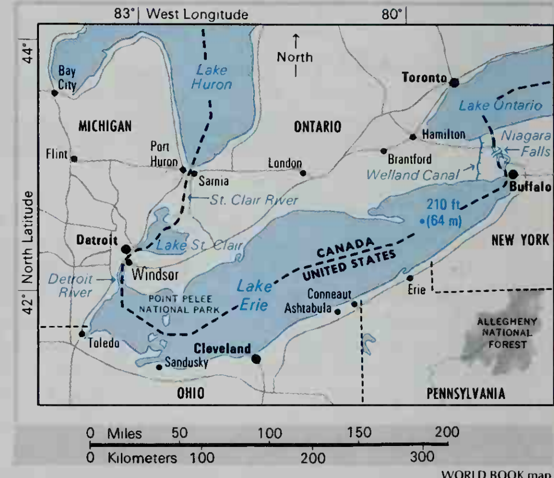
Lake Geneva, *juh NEE vuh,* is one of the largest lakes in central Europe. It was formed by a natural damming of the Rhône River along the border between Switzerland and France. The crescent-shaped lake is 45 miles (70 kilometers) long, and its width ranges from $1\frac{1}{2}$ to 9 miles (2.4 to 15 kilometers). The lake has an area of 225 square miles (585 square kilometers). The French name for Lake Geneva is *Lac Léman,* and its German name is *Genfer See.*

Lake Geneva lies in an area of great beauty, with the Jura Mountains to the north and the French Alps to the south. The Swiss shore is heavily populated, and major rail lines and highways parallel the lake. Major cities on the lake include Geneva, Lausanne, Vevey, and Montreux, all in Switzerland. On an island near the eastern shore stands the historic castle of Chillon that was made famous by Lord Byron's poem "The Prisoner of Chillon."

Howell C. Lloyd

Lake Erie

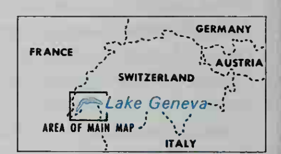


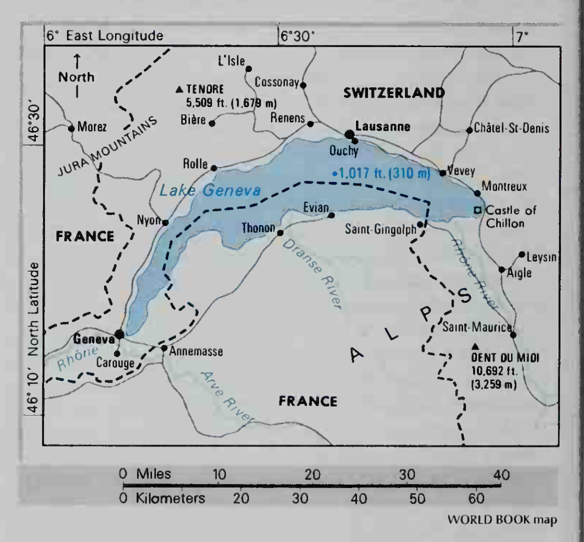


WORLD BOOK map

Lake Geneva

Area: 224 sq. mi. (580 km²)
Elevation: 1,220 ft. (372 m) above sea level
Deepest Point: • 1,017 ft. (310 m)
— Road

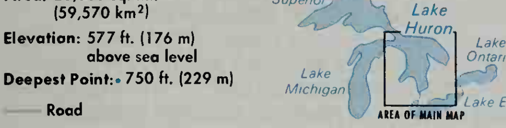


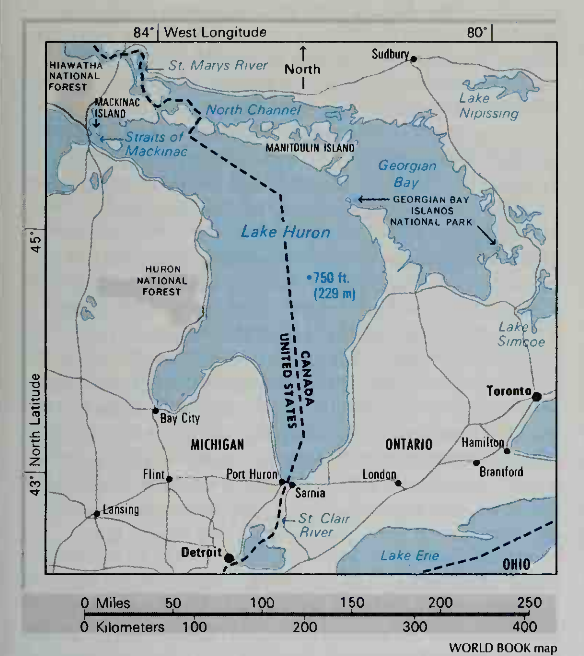


WORLD BOOK map

Lake Huron, *HYUR uhn,* is one of the five Great Lakes of North America. It was named for the Huron Indians who lived on its shores. Lake Huron lies between Lake Michigan and Lake Erie, and forms part of the boundary between the United States and Canada. The lake is about

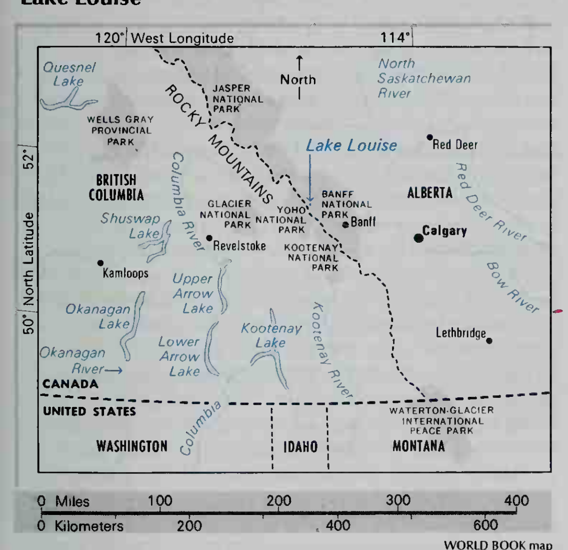
Lake Huron





WORLD BOOK map

Lake Louise



WORLD BOOK map

206 miles (332 kilometers) long, and its greatest width is about 183 miles (295 kilometers). Its area, including the North Channel and Georgian Bay, is 23,000 square miles (59,570 square kilometers).

Huron lies at the same level as Lake Michigan, 577 feet (176 meters) above sea level. The deepest part of Lake Huron is 750 feet (229 meters) below the surface. The lake drains an area of about 51,700 square miles (133,902 square kilometers).

The St. Marys River connects Lake Huron and Lake Superior. The Soo Canals, a set of canals and locks on the river, allow ships to pass between the two lakes. The canal system was built to make up for a 20-foot (6-meter) drop in water level at St. Marys Rapids. The canals have four locks on the United States side and one lock on the Canadian side. The drop in water level at the rapids has also resulted in the construction of hydroelectric power plants to generate electricity.

The Straits of Mackinac connect Lake Huron and Lake Michigan. The waters of Lake Huron flow into Lake Erie by way of the St. Clair River, Lake St. Clair, and the Detroit River.

Lake Huron has many kinds of fish, including lake trout, coho salmon, whitefish, pike, perch, and smallmouth bass. Many islands dot the northern side of the lake. The two most important islands on Lake Huron are Mackinac Island, in Michigan, and Manitoulin Island, in Ontario, Canada. Violent storms that frequently occur between December and May make the lake dangerous for shipping during the winter. Cliffs rise 150 feet (46 meters) on Lake Huron's southeastern shoreline.

A. P. Lino Grima

See also **Georgian Bay; Great Lakes; Soo Canals.**

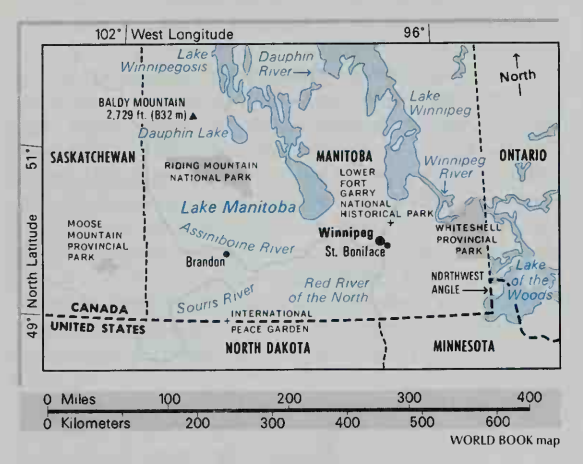
Lake Ilmen, *IHL muhn,* is a freshwater lake in the northwestern part of Russia. For location, see **Russia** (terrain map). Lake Ilmen is about 26 miles (42 kilometers) long and 21 miles (34 kilometers) wide. Rivers entering the lake include the Msta, Lovat', and Shelon'. Lake Ilmen empties north through the Volkhov River into Lake Ladoga. The Msta and Volkhov rivers are linked by two canals, parts of the waterway extending from the Baltic Sea to the Black Sea. Leslie Dienes

Lake Itasca, *eye TAS kuh,* is the source of the Mississippi River. Lake Itasca is located in northwestern Minnesota. See **Mississippi River** (The course of the Mississippi; picture; map); **Minnesota** (Lakes, rivers, and waterfalls).

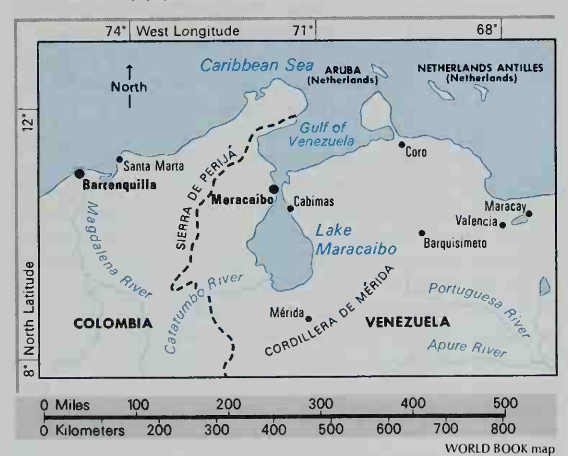
Lake Ladoga, *LAD uh guh* or *LAH duh guh,* in northwestern Russia, is the largest lake located entirely in Europe. It covers 6,835 square miles (17,703 square kilometers). Lake Ladoga lies 40 miles (64 kilometers) northeast of St. Petersburg. For location, see **Russia** (terrain map). Along with Lake Onega to the northeast, Lake Ladoga forms part of a canal system that links the Baltic and White seas (see **Lake Onega**). Ownership of Lake Ladoga was divided between the Soviet Union (of which Russia was then a part) and Finland until 1940. In that year, the Soviet Union took over the entire lake after a war against Finland. During the blockade of Leningrad (now St. Petersburg) by German forces in World War II (1939-1945), supplies were taken to the city across the frozen lake. Leslie Dienes

Lake Louise, *loo EEZ,* located in Banff National Park in southern Alberta, is called *Pearl of the Canadian Rockies.* The lake is quiet and peaceful because it is so sheltered by the Rockies that winds seldom stir its surface. The changeable turquoise waters of the lake, fed by a glacier, mirror the sky and the surrounding dark forests, cliffs, and snowy mountains. More people visit Lake Lou-

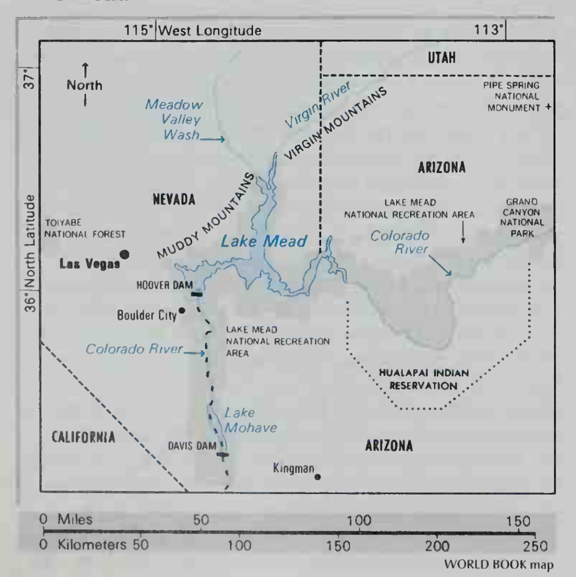
Lake Manitoba



Lake Maracaibo



Lake Mead



ise and Banff National Park than any other places in the Canadian Rockies. The lake is about 1 ½ miles (2.4 kilometers) long and ⅓ mile (0.5 kilometer) wide. It was named in 1884 for Princess Louise, who was the Canadian governor general's wife and a daughter of Queen Victoria. See also **Alberta** (picture). G. Peter Kershaw

Lake Lugano, *loo GAH noh,* lies in the southern foothills of the Alps. It is located in northern Italy and southern Switzerland between Lake Maggiore and Lake Como. For location, see **Italy** (terrain map). The lake is about 20 miles (32 kilometers) long and about 2 miles (3.2 kilometers) wide. Lugano, Switzerland, is the largest city along the lake. The region's economy is based on tourism. A busy rail and road route from the St. Gotthard Tunnel in Switzerland to Milan and Rome in Italy crosses a causeway on the lake near the city of Lugano.

Howell C. Lloyd

Lake Maggiore, *muh JOHR ee,* lies northwest of Milan, Italy, in the foothills of the Alps. Most of the lake is in Italy, but a small part in the north lies in Switzerland (see **Switzerland** [terrain map]). Lake Maggiore is 40 miles (64 kilometers) long and covers 82 square miles (212 square kilometers). In some places, the lake is more than 1,200 feet (366 meters) deep. High mountains overlook the north and west shores of the lake. Many small villages on these shores depend largely on tourism. The lower, more fertile hills to the south support vineyards, orchards, and vegetable crops. Important cities on the lake include Locarno, Switzerland; and Stresa, Italy.

Howell C. Lloyd

Lake Manitoba, *MAN ih TOH buh,* lies in the south-central part of Manitoba. It and Lakes Winnipeg and Winnipegosis are remains of glacial Lake Agassiz, which once occupied much of Manitoba (see **Lake Agassiz**). Lake Manitoba, the smallest of the three lakes, covers 1,785 square miles (4,624 square kilometers). It is 120 miles (200 kilometers) long and 29 miles (47 kilometers) wide and is unusually shallow. It drains through the Dauphin River into Lake Winnipeg. An important waterfowl research station lies at the south end of the lake, at Delta Marsh. John S. Brierley

Lake Maracaibo, *MAR uh KY boh,* is the trade waterway of the farming and rich petroleum region of northwestern Venezuela. Lake Maracaibo is the largest lake in South America. It covers 5,217 square miles (13,512 square kilometers). It is connected with the Caribbean Sea by a short channel and the Gulf of Venezuela. A bridge 5 ½ miles (8.9 kilometers) long crosses the channel. The bridge is high enough to allow oceangoing ships to move under it. There are many oil wells in the lake and along its shores. Wetlands along the shores provide a habitat for wildlife. Gregory Knapp

Lake Mead is the reservoir behind Hoover (Boulder) Dam. It is the largest artificial lake in the United States. It lies about 15 miles (24 kilometers) east of Las Vegas, Nevada. Lake Mead is 115 miles (185 kilometers) long and stores about 28 million acre-feet (35 billion cubic meters) of water. It covers about 250 square miles (650 square kilometers). The lake is the center of a recreational area. The National Park Service administers Lake Mead. See also **Hoover Dam.** Christopher H. Exline

Lake Michigan is the largest body of fresh water in the United States. It is the third largest of the Great Lakes and the only one of the group that lies entirely inside

the United States. Lake Michigan forms an important link in the great waterway system that reaches east to the Atlantic Ocean and south, through the Mississippi River, to the Gulf of Mexico.

Indians who lived on the shores of the lake called it *Michi-guma,* which means *big water. Michi-guma* became *Michigan* through popular use.

General description

Location. Lake Michigan extends southward into Michigan, dividing that state into two peninsulas. Wisconsin and Illinois form its western border. A small part of Indiana touches the southern end of the lake.

Size. Lake Michigan is 307 miles (494 kilometers) long and its greatest width is 118 miles (190 kilometers). It covers 22,300 square miles (57,760 square kilometers).

Surface features. Lake Michigan is 923 feet (281 meters) deep at some points. Its surface is 577 feet (176 meters) above sea level.

Green Bay is the largest arm of Lake Michigan. It lies at the northwestern corner of the lake. Grand Traverse and Little Traverse bays are on the east. Among the large rivers that enter Lake Michigan are the St. Joseph, the Fox, the Kalamazoo, the Grand, and the Menominee. The Chicago River flows out of Lake Michigan. It once flowed into the lake, but its course was reversed (see **Chicago Sanitary and Ship Canal**).

Commerce

Routes. Lake Michigan empties into Lake Huron through the Straits of Mackinac. The St. Lawrence Seaway connects it with the Atlantic Ocean. Lumber, grain, and mineral products from this region are shipped to all parts of the world. The Chicago Sanitary and Ship Canal and the Chicago and Illinois rivers connect the lake with the Mississippi River.

Ports. Among the important Michigan ports on the lake are Escanaba, Frankfort, Grand Haven, Ludington, Manistee, Menominee, Muskegon, Port Dolomite, Port Inland, and Stoneport. Important Wisconsin ports are Green Bay, Kewaunee, Manitowoc, Milwaukee, Oak Creek, Port Washington, Racine, and Sheboygan. Gary and Indiana Harbor are important Indiana ports. Chicago and Waukegan are the busiest Illinois ports on the lake.

A. P. Lino Grima

See also **Chicago; Great Lakes; Green Bay; Michigan** (Climate).

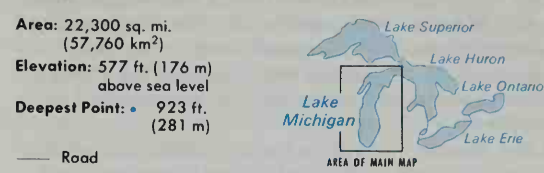
Lake Nasser was formed when waters of the Nile River were blocked by the Aswan High Dam in Egypt. It was named for Gamal Abdel Nasser, who was president of Egypt. The dam, which began operating in 1968, is 425 miles (684 kilometers) south of Cairo. The lake completely filled in 1981. It covers about 1,550 square miles (4,014 square kilometers). Water from the lake is used to irrigate land and generate hydroelectric power. The *Abu Simbel* temples, built by the pharaoh Ramses II, were cut out of cliffs along the Nile and moved to higher ground to escape the rising waters (see **Abu Simbel, Temples of**). Michael L. McNulty

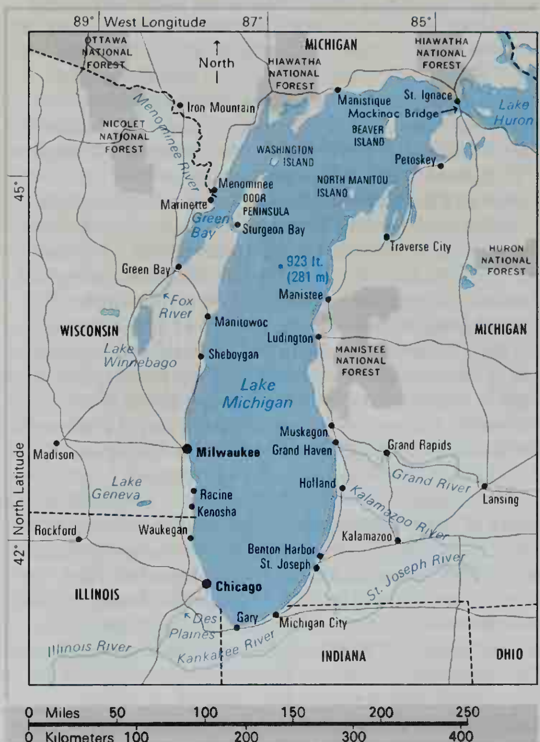
See also **Aswan High Dam.**

Lake Neagh. See **Lough Neagh.**

Lake Nicaragua, NIHK *uh RAH gwuh,* lies in western Nicaragua, about 12 miles (19 kilometers) east of the Pacific Ocean and 70 miles (113 kilometers) west of the

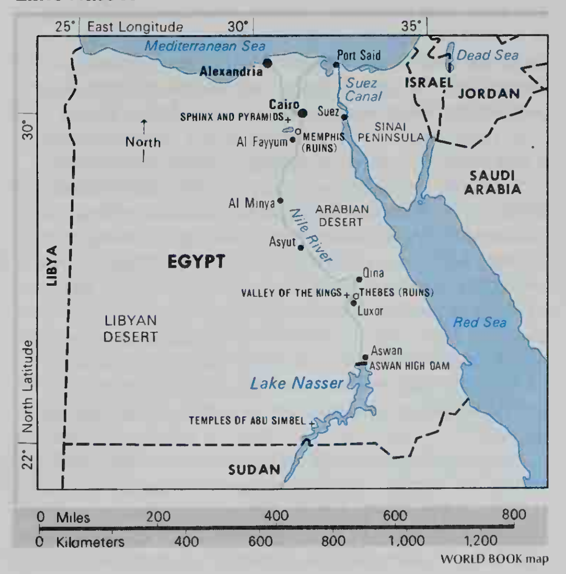
Lake Michigan





WORLD BOOK map

Lake Nasser



WORLD BOOK map

Caribbean Sea. For location, see **Nicaragua** (map). The lake covers 3,060 square miles (7,925 square kilometers) and is 96 miles (154 kilometers) long and 39 miles (63 kilometers) wide. Several large islands lie in the lake. Ometepe, the biggest, has two volcanoes. The Tipitapa River connects Lake Nicaragua with Lake Managua on the north. Gary Brana-Shute

Lake Nyasa, *ny AS uh,* is the southernmost of a chain of large freshwater lakes in the Great Rift Valley of eastern Africa. It lies about 400 miles (640 kilometers) inland from the Indian Ocean. Lake Nyasa, also called Lake Malawi, flows into the Indian Ocean by way of the Shire and Zambezi rivers (see **Malawi**). The lake is 350 miles (563 kilometers) long and has an area of 11,100 square miles (28,749 square kilometers). Its waters are 2,300 feet (701 meters) deep. Michael L. McNulty

Lake of Lucerne, *loo SURN,* lies in central Switzerland. For location, see **Switzerland** (map). The lake covers 44 square miles (114 square kilometers). It has the form of a rough cross, 24 miles (39 kilometers) long and 2 miles (3 kilometers) wide. The lake is surrounded by four of Switzerland's oldest *cantons* (states)—Luzern, Schwyz, Unterwalden, and Uri. German-speaking Swiss call the lake *Vierwaldstätter See,* which means *Lake of Four Forest Cantons.* Tourism dominates the area's economy. The region near the eastern end of the lake is the scene of some of the adventures of the legendary Swiss patriot William Tell (see **Tell, William**).
Howell C. Lloyd

Lake O' The Cherokees, *CHEHR uh keez,* is an artificially created lake in northeastern Oklahoma. The lake is formed by Pensacola Dam on the Neosho or Grand River. It was created in 1940. The lake is 66 miles (106 kilometers) long and has about 1,300 miles (2,090 kilometers) of shoreline. It is the center of a leading resort area. The dam supplies electric power and flood control for the surrounding area. James Matthai

Lake of the Ozarks, *OH zahrks,* was formed by the completion of the Bagnell Dam on the Osage River in 1931. The lake and its environs have become a popular resort and recreation center. The lake winds for about 130 miles (209 kilometers) among the Ozark Mountains of central Missouri. Dale Robert Martin

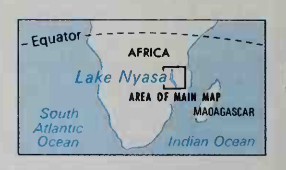
Lake of the Woods lies on the boundary between Canada and the United States. Some of the first trading posts in the West were located on the shores of this lake. Today, the lake is best known as a summer resort. It was named for the forests that cover its hilly shores and islands. The lake covers about 1,485 square miles (3,846 square kilometers), most of which lie in Ontario. Two small bays are in Manitoba. The rest of the lake borders Minnesota. The northernmost part of the continental United States, excluding Alaska, is on the lake's western shore. The lake is 100 miles (160 kilometers) long and from 10 to 50 miles (16 to 80 kilometers) wide.

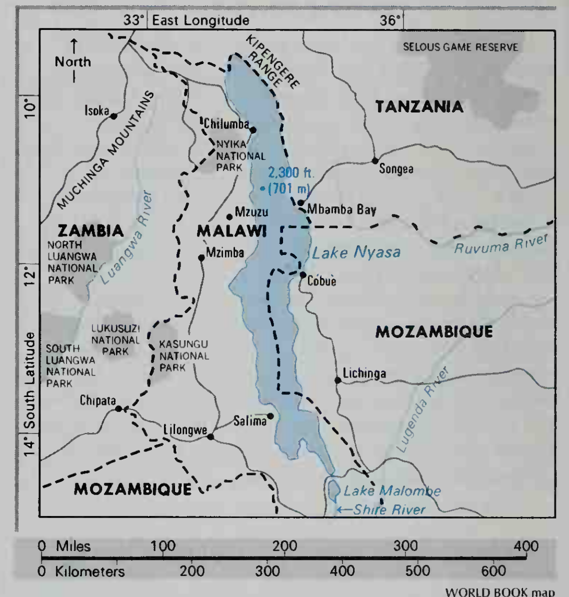
Tourism is the chief industry of the region. Fishing, particularly sport fishing, also is important. Highways and railways run along the lake's northern and southern shores.

The Lake of the Woods was an important factor in several boundary disputes between the United States and Great Britain. According to the treaty that ended the Revolutionary War in America (1775-1783), the boundary was to run from the northwest angle of the lake "on a

Lake Nyasa

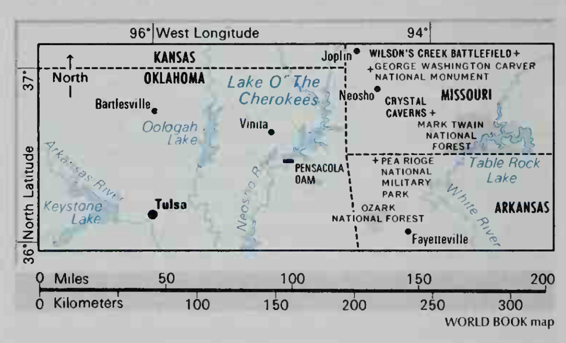
Area: 11,100 sq. mi. (28,749 km²)
Elevation: 1,550 ft. (472 m) above sea level
Deepest Point: 2,300 ft. (701 m)
— Road





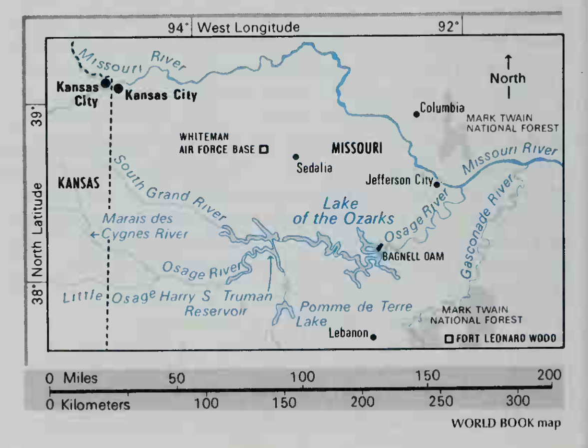
WORLD BOOK map

Lake O' The Cherokees



WORLD BOOK map

Lake of the Ozarks

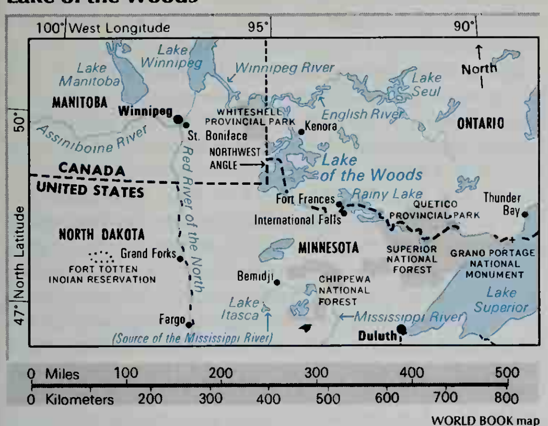


WORLD BOOK map

due course west to the river Mississippi." The source of the Mississippi was later found to be 100 miles (160 kilometers) farther south. The Convention of London fixed the present boundary in 1818. George B. Priddle

Lake of Thun, *toon,* lies 1,830 feet (558 meters) above sea level in the Bernese Alps in central Switzerland. It is about 30 miles (50 kilometers) southeast of Bern (see **Switzerland** [terrain map]). Formed by the Aare River, the lake is 10 miles (16 kilometers) long and covers 18 square miles (47 square kilometers). An important transport junction occurs at the town of Spiez, where the Simme River enters the lake. A major road and a railway along the lake's south shore connect the cities of Thun at its west end and Interlaken near its east end. The region's economy consists mainly of tourism and light manufacturing. Howell C. Lloyd

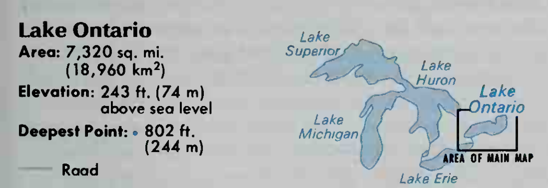
Lake of the Woods

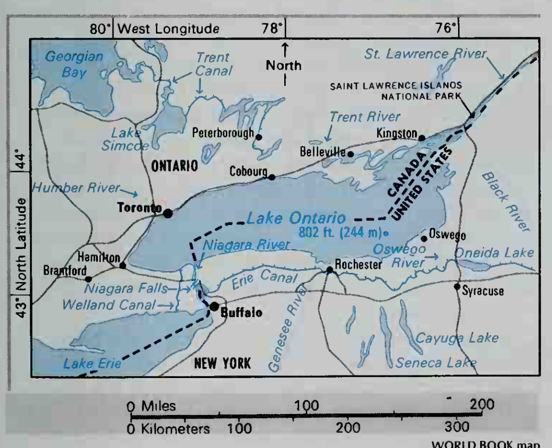


WORLD BOOK map

Lake Ontario

Area: 7,320 sq. mi. (18,960 km²)
Elevation: 243 ft. (74 m) above sea level
Deepest Point: • 802 ft. (244 m)
—— Road





WORLD BOOK map

Lake Okeechobee, *OH kee CHOH bee,* is the largest lake in the Southern United States. Okeechobee is a Seminole Indian word that means *plenty big water.* The lake lies in south-central Florida and borders the northern part of the Everglades (see **Everglades**). It covers about 700 square miles (1,800 square kilometers) and has an average depth of 9 feet (2.7 meters). For the lake's location, see **Florida** (physical map).

Cypress swamps and a dike to prevent flooding line the lake's shores. A system of canals provides outlets to the Atlantic Ocean and the Gulf of Mexico. The canals are vital in supplying water to the urban area along southern Florida's Atlantic coast. Peter O. Muller

Lake Onega, *oh NEHG uh* or *uh NYEH guh,* is one of the largest lakes in Europe. It is located in northwestern Russia (see **Russia** [terrain map]). Lake Onega covers 3,820 square miles (9,894 square kilometers). It empties into the Svir River, which flows into Lake Ladoga about 70 miles (110 kilometers) to the southwest.

Lake Onega and Lake Ladoga are part of a canal system that links the Baltic and White seas. The system was completed in 1933, when the government of the Soviet Union used political prisoners to build a canal joining Lake Onega to the White Sea. Many of the prisoners died of cold or starvation during the construction of the waterway. That canal did not fully function. But by the 1980's, construction improvements had made it a major waterway. Leslie Dienes

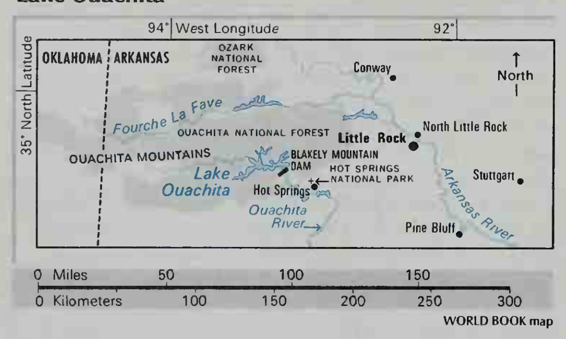
Lake Ontario is the smallest and most eastern of the five Great Lakes. It forms an important link in the St. Lawrence Seaway system. Although Lake Ontario is open to large ships throughout the year, it has less traffic than the other Great Lakes.

Lake Ontario lies between the province of Ontario and the northwestern part of New York. The lake is 193 miles (311 kilometers) long and 53 miles (85 kilometers) wide. It covers an area of 7,320 square miles (18,960 square kilometers). The shore of the lake is about 480 miles (772 kilometers) around. Offshore, the lake is very deep, ranging from 500 to 802 feet (152 to 244 meters). Its surface lies about 243 feet (74 meters) above sea level. The great depth of the lake, together with its low-lying surface, means that two-thirds of its waters lie below sea level and are not touched by surface winds and currents. A steady top current moves across the lake from west to east at a rate of about $\frac{1}{3}$ mile (0.5 kilometer) per hour.

Lake Ontario does not freeze in winter, except along the shore, where the water is more shallow. The depth of its waters makes its surface cooler than the air above in summer, and warmer in winter. So the lake has a moderating effect on the climate of the area. The temperature of the southern shore is so moderate that fruit trees grow throughout this region on both sides of the United States-Canada border.

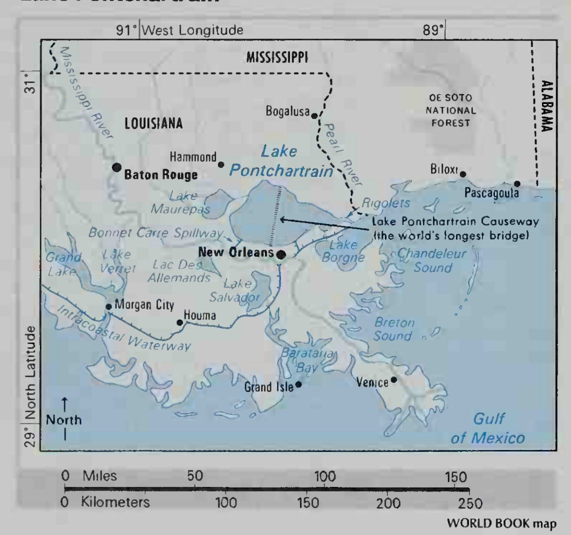
Lake Ontario empties into the Atlantic Ocean through the St. Lawrence River. The Niagara River and the Welland Canal connect it to Lake Erie on the southwest. It is connected with the Hudson River and New York City by the Erie Canal, the Genesee River, and the Oswego Canal. The rivers that empty into Lake Ontario include the Black, Genesee, Oswego, Trent, and Humber. The lake has many good harbors. The chief lake ports include Rochester and Oswego, N.Y. Important Canadian

Lake Ouachita



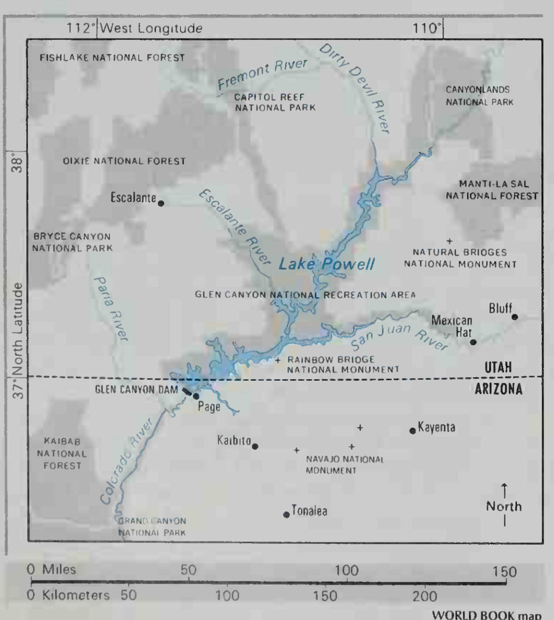
WORLD BOOK map

Lake Pontchartrain



WORLD BOOK map

Lake Powell



WORLD BOOK map

ports are Cobourg, Toronto, Hamilton, and Kingston.

A. P. Lino Grima

See also **Great Lakes; Saint Lawrence Seaway.**

Lake Ouachita, *WAHSH ih taw,* is an artificially created lake near Hot Springs, Ark. The lake covers about 63 square miles (163 square kilometers). It is about 20 miles (32 kilometers) long and about 5 miles (8 kilometers) wide at its widest point. It has 690 miles (1,110 kilometers) of shoreline. Lake Ouachita is formed by the Blakely Mountain Dam on the Ouachita River. It was created in 1955. The lake provides flood control and hydroelectric power and is also used for recreation. Lake Ouachita is located in the Ouachita National Forest. Ouachita State Park lies along the lake. John G. Hehr

Lake Peipus, *PY puhs,* lies on the border between Estonia and Russia. For location, see **Russia** (terrain map). Lake Peipus is 93 miles (150 kilometers) long and covers 1,400 square miles (3,626 square kilometers). In 1242, the frozen lake was the scene of a historic battle between Slavic forces and members of the Teutonic Knights. During World War II (1939-1945), the lake area was the scene of heavy fighting between German troops and troops of the Soviet Union. Leslie Dienes

Lake Placid, *PLAS uhd,* is one of the small, beautiful lakes in the Adirondack Mountains of Essex County, New York. Glaciers formed the lakes in this area during the Ice Age. Lake Placid is about $3\frac{1}{2}$ miles (5.6 kilometers) long and $1\frac{1}{2}$ miles (2.4 kilometers) wide. There are two large islands in the middle of the lake.

The village of Lake Placid, a famous summer and winter resort, is near the lake's southern end. Summer activities of the area include boating, golf, hiking, mountain climbing, swimming, and tennis. In winter, visitors enjoy bobsledding, hockey, ice skating, and skiing. The Winter Olympics took place at Lake Placid in 1932 and in 1980. Abolitionist John Brown is buried south of the village.

Michael K. Heiman

See also **New York** (picture).

Lake Poets were William Wordsworth, Samuel Taylor Coleridge, and Robert Southey. They were so named by the *Edinburgh Review* in 1817 because they lived in the Lake District of northwestern England. Each of them had become politically conservative, but otherwise they shared only a dislike of the stuffy, formal poetry that was common in their time. They cultivated a simple style of verse, using realistic speech patterns. Originally, the term *Lake Poets* was applied scornfully both by the *Edinburgh Review* and by poet Lord Byron, who disapproved of the writers' rejecting their earlier liberal ideals. Now, however, the term is purely descriptive.

Wordsworth celebrated spiritual experience in the natural world. He wrote many poems about humble people and familiar objects, using conversational language. Coleridge was more philosophical and more visionary. His writing included commentaries on Shakespeare and other works of critical theory. Southey was less talented as a writer than Wordsworth and Coleridge. He wrote tales in verse as well as history.

Frederick W. Shilstone

See also the separate articles on each of the Lake Poets and **English literature** (Romantic poetry).

Lake Pontchartrain, *PAHN chuhr TRAYN,* is a beautiful lake of brackish water in southeastern Louisiana. It is 40 miles (64 kilometers) long and 25 miles (40 kilome-

ters) wide, and covers 625 square miles (1,619 square kilometers). It is a major recreational center. The Inner Harbor Navigation Canal connects the lake with the Mississippi River to the south. New Orleans lies between the lake and the river. If the river begins to flood, some of its water is forced into the lake through a channel called the Bonnet Carré Spillway. The excess water drains from the lake into the Gulf of Mexico through a strait called the Rigolets. The Lake Pontchartrain Causeway, which spans the lake, is the world's longest bridge and longest overwater highway. It is 29.2 miles (47 kilometers) long, with 23.9 miles (38.5 kilometers) over water. French colonists in Louisiana named Lake Pontchartrain for the Comte de Pontchartrain, minister of marine under Louis XIV. E. Fran Stallings

Lake Powell is one of the largest artificially created lakes in the world. It lies on the Utah-Arizona border. Glen Canyon Dam, built across Glen Canyon to generate hydroelectric power, created Lake Powell. The lake was named after Major John Wesley Powell, who discovered and named Glen Canyon. The dam blocks the Colorado River to form a lake 186 miles (299 kilometers) long and about 500 feet (150 meters) deep at its deepest point. Most of the lake is in Utah. The town of Page, Ariz., was built alongside Glen Canyon Dam to house construction workers. Lake Powell is a popular recreation area.

Lay James Gibson

Lake Rudolf. See **Lake Turkana**.

Lake Saint Clair, together with the St. Clair River on the north and the Detroit River on the south, forms a waterway connecting Lakes Huron and Erie. For location, see **Ontario** (physical map). Lake St. Clair has been dredged so that large ships can cross it. Roughly heart-shaped, the lake is 25 miles (40 kilometers) across at the center and covers an area of 460 square miles (1,191 square kilometers). It forms part of the boundary between the state of Michigan and the province of Ontario.

George B. Priddle

Lake Superior, one of the five Great Lakes of North America, is the largest body of fresh water in the world. Among the Great Lakes, it is the deepest, the highest above sea level, and the farthest north and west (see **Great Lakes**). Lake Superior forms part of an important interior waterway of the United States and Canada. This waterway extends from the Atlantic Ocean through the St. Lawrence Seaway and the Great Lakes (see **Saint Lawrence Seaway**). French fur traders gave the name *Lac Supérieur,* French for *Upper Lake,* to the lake.

Location and size. Lake Superior lies across the U.S.-Canadian border. The Canadian province of Ontario is to the north and east of the lake. The U.S. states of Michigan and Wisconsin lie to the south of the lake, and the state of Minnesota to the west.

Lake Superior covers 31,700 square miles (82,100 square kilometers). Its greatest length from east to west is 350 miles (563 kilometers), and its greatest width is 160 miles (257 kilometers). The lake lies 600 feet (183 meters) above sea level and is 1,330 feet (405 meters) deep at its deepest point.

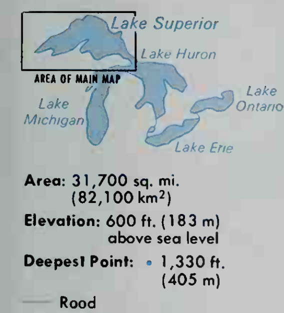
Description. The coastline of Lake Superior is bold and rocky. In some places, especially along the northern shore, cliffs rise from the water's edge. Colorful sandstone walls, known as the Pictured Rocks, rise along some areas of the lake's shore in Michigan. The highway that follows the rocky Minnesota shore is lined with summer resorts, fishing villages, and state parks. Split Rock Lighthouse warns lake shipping from reefs in Beaver Bay along the Minnesota shore.

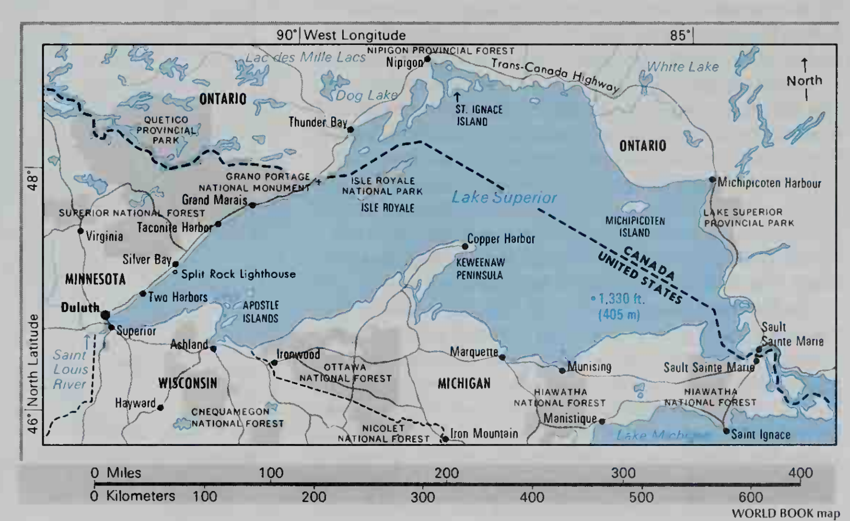
Forests cover almost all of the land that borders the lake. About 200 rivers, most of them short, empty into Lake Superior. Many of these rivers form waterfalls that plunge over the high, rocky headlands. The largest river emptying into the lake is the St. Louis River, which drains into the lake's western end. The Keweenaw Peninsula, known for its copper deposits, juts into the lake in Michigan.

Many islands dot the surface of Lake Superior. The largest are Michigan's Isle Royale and Ontario's St. Ignace and Michipicoten. Small islands called the Apostle Islands lie off the northern Wisconsin shore.

Recreation and commerce. There are few people or factories along the shoreline of Lake Superior. As a result, it is the least polluted of the Great Lakes and is popular for fishing and other recreational activity.

Lake Superior





For years, lake trout had been fished heavily in Lake Superior. But by the late 1950's, fish called lampreys had killed almost all the trout. Scientists added a chemical to the lake's tributaries, where the lampreys breed. The chemical killed the lamprey larvae but did not harm other fish. By the mid-1960's, the number of lampreys in Lake Superior had been significantly reduced. Wildlife officials then stocked the lake with trout and other fishes. Periodic chemical treatments and other measures keep the lamprey population low. See **Lamprey**.

The lake does not freeze over in winter, but frozen harbors restrict shipping. The shipping season extends from about mid-April to December. Boats carry iron ore, taconite, wheat, lumber, copper, and other minerals to ports along the Great Lakes and farther east. The locks of the Soo Canals in Sault Ste. Marie carry ships around the rapids of the St. Marys River (see **Soo Canals**). This river connects Lake Superior and Lake Huron. The chief ports on Lake Superior are Duluth, Two Harbors, Taconite Harbor, Silver Bay, and Grand Marais, all in Minnesota; Superior and Ashland, Wisconsin; Marquette, Michigan; and Thunder Bay and Michipicoten Harbour, Ontario. A. P. Lino Grima

Lake Tahoe, *TAH hoh,* is a beautiful, oval-shaped, glacial lake that lies in a valley of the Sierra Nevada on the California-Nevada border. The lake is 22 miles (35 kilometers) long and 12 miles (19 kilometers) wide. It lies 6,228 feet (1,898 meters) above sea level. Lake Tahoe is 1,640 feet (500 meters) deep at its deepest point and is one of the deepest lakes in the continental United States. It empties through the Truckee River into Pyramid Lake. Camps, homes, and resorts line Lake Tahoe's shores. The lake and the mountain streams that feed it attract fishing enthusiasts. Boating, water-skiing, and hunting are also popular. In 1844, the American explorer John C. Frémont became the first white person to see the lake. See also **Nevada** (picture). Christopher H. Exline

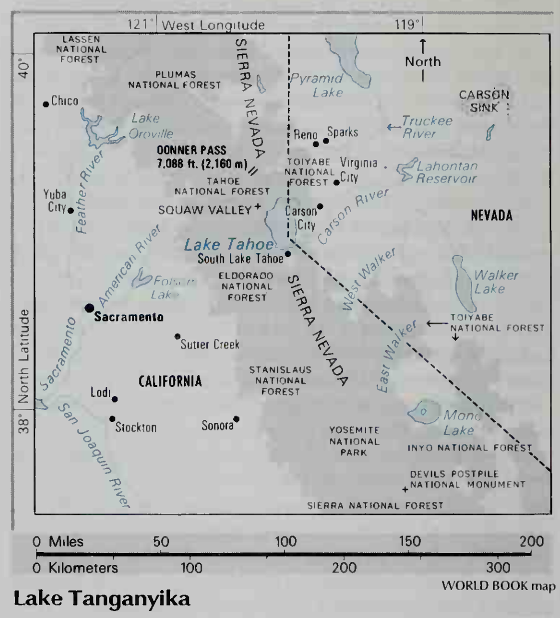
Lake Tana, *TAH nah,* also called Tsana, *TSAH nah,* lies in northwestern Ethiopia (see **Ethiopia** [map]). It serves as the main source of the Blue Nile, or Abbai River. The Blue Nile gets its color from the silt-free water of Lake Tana. Lying 6,000 feet (1,829 meters) above sea level, Lake Tana is 47 miles (76 kilometers) long and 44 miles (71 kilometers) wide. Michael L. McNulty

Lake Tanganyika, *TANG guhn YEE kuh,* in east-central Africa, is the world's longest freshwater lake and the second deepest. Only Lake Baikal, in Russia, is deeper. The lake is bordered by Burundi and Tanzania on the east and by Congo (Kinshasa) and Zambia on the west. It is 420 miles (680 kilometers) long, and its greatest depth is 4,708 feet (1,435 meters). The lake covers about 12,700 square miles (32,900 square kilometers). Lake Tanganyika's shores are mountainous. Only one major river, the Rusizi, drains into the lake. It flows from Lake Kivu in the north. The lake's outlet is the Lukuga River.

The first Europeans to see Lake Tanganyika were Richard Francis Burton and John Hanning Speke. They reached Ujiji, on the eastern shore, in 1858. Henry M. Stanley found the missing missionary-explorer, David Livingstone, at the same point in 1871 (see **Stanley and Livingstone**). Hartmut S. Walter

Lake Texoma is one of the largest artificially created lakes in the United States. It covers about 140 square miles (363 square kilometers) on the Texas and Okla-

Lake Tahoe



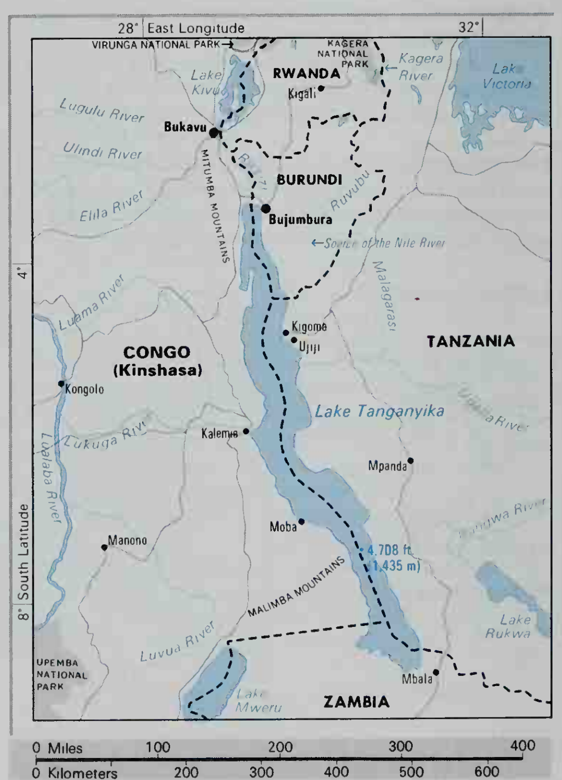
WORLD BOOK map

Lake Tanganyika

Area: 12,700 sq. mi. (32,900 km²)
Elevation: 2,534 ft. (772 m) above sea level
Deepest Point: 4,708 ft. (1,435 m)

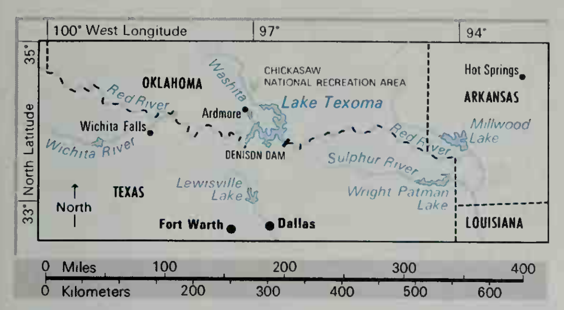
Road

Equator
Lake Tanganyika
AREA OF MAIN MAP
South Atlantic Ocean
AFRICA
MADAGASCAR
Indian Ocean



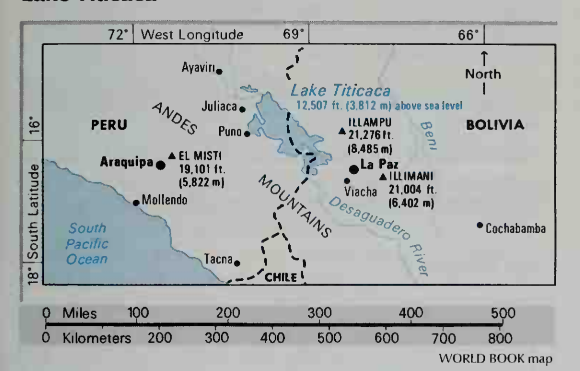
WORLD BOOK map

Lake Texoma



WORLD BOOK map

Lake Titicaca

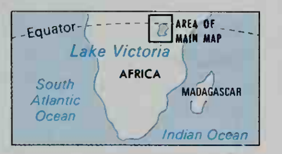


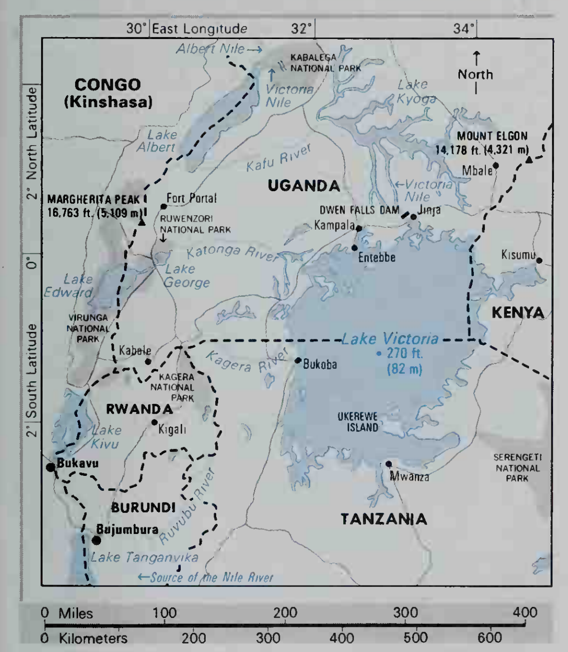
WORLD BOOK map

Lake Victoria

Area: 26,828 sq. mi. (69,484 km²)
Elevation: 3,723 ft. (1,135 m) above sea level
Deepest Point: • 270 ft. (82 m)

— Road ‖ Waterfall





WORLD BOOK map

homa border, about 80 miles (130 kilometers) south of Oklahoma City.

The lake was formed in 1944 by Denison Dam, which was built on the Red River to produce hydroelectric power, control floods, and allow navigation. Lake Texoma has become popular for fishing, hunting, and water sports. Keith D. Harries

Lake Tiberias. See **Galilee, Sea of.**

Lake Titicaca, *TEE tee KAH kah,* is the highest navigable lake in the world. Located on the border between Peru and Bolivia, it lies 12,507 feet (3,812 meters) above sea level. The lake is 110 miles (180 kilometers) long and about 45 miles (72 kilometers) wide. It covers about 3,200 square miles (8,300 square kilometers) and is more than 900 feet (270 meters) deep in places. The Desaguadero River flows out of its southern end and empties into Lake Poopó in Bolivia.

Many islands lie in the lake. Some have ruins of Indian civilizations that existed before the Spanish conquest of South America in the 1500's. Numerous Indian villages lie near Lake Titicaca's shore. Many villagers make boats from reeds called *totoras,* which grow on the shores of the lake. These boats provide transportation for local Indian commerce (see **Bolivia** [picture: Lake Titicaca]; **South America** [picture]). Trout are found in Lake Titicaca. Some of these fish are about 3 feet (1 meter) long. Robert C. Eidt

Lake Torrens, *TAWR uhnz,* is a shallow body of salt water in South Australia. The lake is 120 miles (193 kilometers) long and 40 miles (64 kilometers) wide. It has an area of 2,230 square miles (5,776 square kilometers). For the location of Lake Torrens, see **Australia** (terrain map). D. N. Jeans

Lake Trasimeno, Battle of. See **Hannibal** (His military campaigns).

Lake trout. See **Trout.**

Lake Turkana, *TUHR KAN uh,* is a long, narrow lake in east-central Africa. Most of it lies in northern Kenya. Its northern tip extends into southern Ethiopia. For location, see **Kenya** (map). The lake covers 2,473 square miles (6,405 square kilometers).

Lake Turkana is known for its plentiful supply of large fish, especially huge Nile perch. Turkana people inhabit the shore and fish and raise livestock for a living. Many Nile crocodiles breed in the Lake Turkana area. Koobi Fora National Park, on the lake's east shore, contains fossils of early forms of human beings and wildlife. Lake Turkana receives fresh water from rivers of the Ethiopian highlands. However, the lake has no outlet, and the region's hot, dry climate causes a high rate of evaporation of the fresh water. As a result, the lake's water is slightly salty.

Lake Turkana first became known to Europeans after an expedition from Austria-Hungary reached it in 1888. The African people of the area then called the lake Basso Narok (Dark Water). The European expedition was led by Samuel Teleki, a Hungarian count. Teleki named the body of water Lake Rudolf in honor of Rudolf, the crown prince of Austria-Hungary. The lake is still sometimes called Lake Rudolf. Hartmut S. Walter

Lake Victoria, or, in Bantu, Victoria Nyanza, is the largest lake in Africa and the second largest freshwater lake in the world. Its area of 26,828 square miles (69,484 square kilometers) is exceeded only by that of Lake Su-

perior. Lake Victoria lies in east-central Africa, partly in Kenya, partly in Tanzania, and partly in Uganda. The equator crosses the lake.

Lake Victoria is the chief source of the Nile River. Owen Falls Dam, built across the Nile between 1949 and 1954, has raised Lake Victoria's level about 3 feet (91 centimeters) to 3,723 feet (1,135 meters) above sea level. Its greatest depth is 270 feet (82 meters). More than 200 species of tropical fish live in the lake.

In 1858, the English explorer John Hanning Speke became the first European to reach Lake Victoria. He named the lake in honor of Queen Victoria of the United Kingdom. Hartmut S. Walter

Lake Volta, *VAHL tuh* or *VOHL tuh,* in central Ghana, is one of the world's largest artificially created lakes. It is the reservoir behind Akosombo Dam on the Volta River. Lake Volta extends 250 miles (402 kilometers) north of the dam and was formed by the completion of the dam in 1965. The lake covers an area of 3,275 square miles (8,482 square kilometers). The power station at Akosombo Dam uses water from Lake Volta to generate electric power for the area. Michael L. McNulty

Lake Windermere. See Windermere.

Lake Winnebago, *WIHN uh BAY goh,* the largest lake in Wisconsin, covers 215 square miles (557 square kilometers) in the east-central part of the state. It is about 30 miles (48 kilometers) long, and 5 to 10 miles (8 to 16 kilometers) wide. The Fox River enters the lake on the west at Oshkosh, and leaves at the northwest end at Neenah and Menasha. Fond du Lac lies along the southern shore. For the location of Lake Winnebago, see **Wisconsin** (physical map). Gary C. Meyer

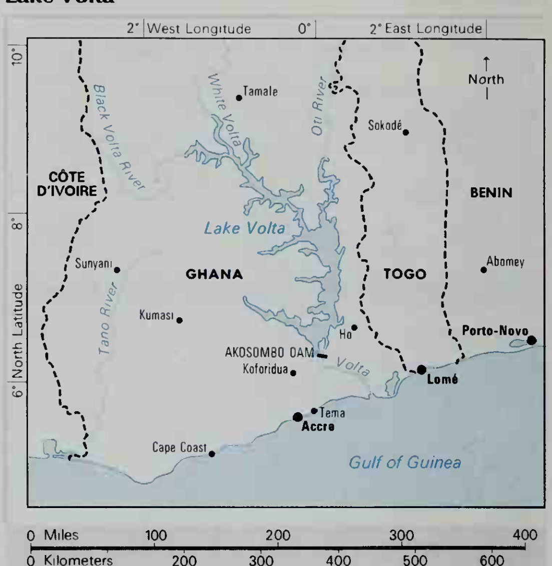
Lake Winnipeg, *WIHN uh PEHG,* in south-central Manitoba, is the third largest lake lying entirely within Canada. Only Great Bear Lake and Great Slave Lake in the Northwest Territories are larger. Lake Winnipeg covers 9,416 square miles (24,387 square kilometers) and is known as one of the "Great Lakes of Manitoba" (see **Manitoba** [Rivers and lakes]). It is 258 miles (416 kilometers) long, from 20 to 60 miles (32 to 97 kilometers) wide, and does not exceed 70 feet (21 meters) in depth.

In ancient times, Lake Winnipeg and its two large neighbors—Lakes Winnipegosis and Manitoba—formed parts of large, shallow Lake Agassiz, created by glaciers during the most recent ice age which ended about 11,500 years ago (see **Lake Agassiz**). Large islands in Lake Winnipeg include Reindeer Island and Hecla Island. The lake's fisheries are the most important in Manitoba. Lake Winnipeg is a storage reservoir for a river system that includes the Saskatchewan, Nelson, Red, and Winnipeg rivers. John S. Brierley

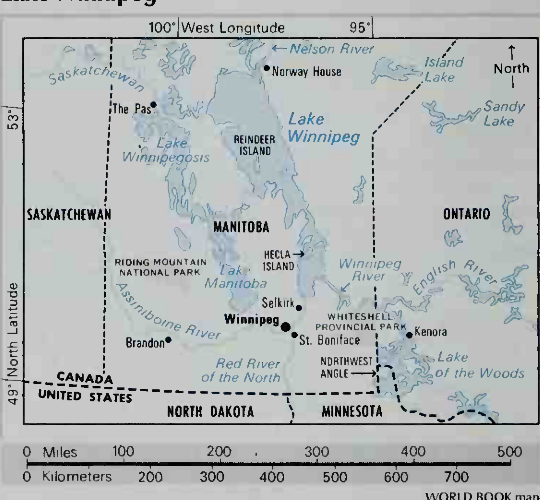
Lake Winnipegosis, *WIHN uh puh GOH sihs,* lies in the lowlands of southern Manitoba. It covers 2,075 square miles (5,374 square kilometers), and is about 120 miles (193 kilometers) long, 20 miles (32 kilometers) wide, and 38 feet (12 meters) deep. The lake drains into Lake Manitoba by way of the Waterhen River. For the location of Lake Winnipegosis, see Manitoba (physical map). Lake Winnipegosis formed part of Lake Agassiz during the most recent ice age which ended about 11,500 years ago. See also Lake Agassiz. John S. Brierley

Lake Xochimilco, *SOH chee MEEL koh,* was one of four lakes that filled the Valley of Mexico at the time of the Spanish conquest in 1521. The freshwater lakes lay

Lake Volta



Lake Winnipeg

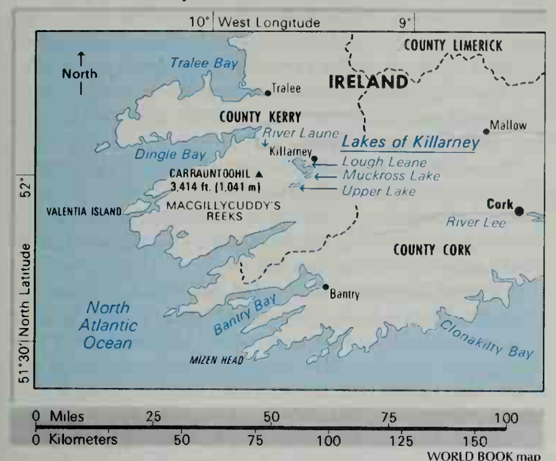


south of the Aztec capital Tenochtitlan, now Mexico City. For location, see **Mexico City** (map). The lakes were the site of *chinampas,* fertile islands that the Aztecs created by alternating layers of mud and marsh plants. Although chinampas do not float, they are often called *floating gardens.* These areas still provide vegetables and flowers for Mexico City. Brightly painted boats carry tourists through the canals. John J. Winberry

Lakeland terrier is a breed of dog that originated in the 1800's in the Lake District of northern England. It was developed to hunt foxes and protect sheep. This small dog has a rectangular head with a bearded chin. It has a soft undercoat and a wiry outer coat. The coat is usually tan with a reddish-black *saddlemark* (marking on the back and sides). The coat also may be a solid tan. The lakeland terrier weighs from 15 to 17 pounds (7 to 8 kilograms). It is a popular pet and show dog.

Critically reviewed by the United States Lakeland Terrier Club

Lakes of Killarney



WORLD BOOK map

Lakes of Killarney, *kih LAHR nee,* are three famous lakes of great beauty in County Kerry, in southwestern Ireland. They are one of Ireland's main tourist areas. The Lakes of Killarney lie southwest of the town of Killarney. Lough Leane, or Lower Lake, covers nearly 8 square miles (20 square kilometers). Muckross Lake, or Middle Lake, covers about 1 square mile (2.7 square kilometers). Upper Lake is about two-thirds that size. Upper Lake lies in a valley in sandstone mountains. The two lower lakes lie at the foot of the mountains. The lakes are joined by a lovely river, the Long Range. They drain through the River Laune into Dingle Bay. Much of the lakes and surrounding mountains and woodlands form Killarney National Park. The center of the park is at Muckross House and Gardens, on a peninsula that separates the lower lakes. Nearby are the ruins of Muckross Abbey, which was built in the 1400's. Desmond A. Gillmor

La Leche League International, *lah LAY chay,* is an organization of women who offer information and encouragement to mothers who want to breast-feed their babies. The Spanish words *la leche* mean *the milk.* The league provides counseling and education to parents and professionals through meetings, seminars, and publications. Its publications include a book called *The Womanly Art of Breastfeeding.* The league also distributes brochures on childbirth, child care, and related subjects. It directs group discussions for mothers who are breast-feeding and other interested women.

La Leche members believe breast-feeding contributes to a child's well-being and promotes good mother-child relationships. A group of mothers founded the organization in 1956. Today, it has about 3,600 local groups in the United States and about 40 other countries. The headquarters is located in Franklin Park, Illinois.

Critically reviewed by La Leche League International


WORLD BOOK photo by E. F. Hoppe

The lakeland terrier comes from northern England.

Lalo, *la LOH,* **Édouard,** *ay DWAR* (1823-1892), was a French composer. His best-known work, *Symphonie Espagnole* (1875), is a five movement violin concerto that features Spanish themes. Lalo's other important compositions include the *Cello Concerto* (1877), the ballet *Namouna* (1882), and the opera *Le Roi d'Ys* (1888). Lalo was largely responsible for reviving interest in chamber music in France in the 1850's. In 1855, he helped found a chamber music group called the Armingaud-Jacquard Quartet in which he played viola and violin. Lalo was born in Lille. Vincent McDermott

Lamaism, *LAH muh ihz uhm,* is a form of Buddhism practiced in Tibet and Mongolia. It is usually called *Tibetan Buddhism.* Lamaism is named for the Buddhist *Lamas* (monks), who teach the faith. Many Lamaists follow a branch of Buddhism called *tantrism,* which stresses meditation and secret rituals.

Shortly before A.D. 650, monks from India introduced Buddhism into Tibet. Through the years, Buddhism was combined with traditional Tibetan religious beliefs to form Lamaism. The Lamaists built monasteries called *Lamaseries,* which became political and educational centers in Tibet. Between 900 and 1400, several Lamaist sects developed in Tibet, including the Gelugspa, Karmapa, Sakyapa, Brugpa, and Nyingmapa. The most powerful one was called the Yellow Hat sect because its monks wore yellow uniforms. The sect leader became known as the *Dalai Lama.* From the mid-1600's until 1950, the Dalai Lama was Tibet's supreme political and spiritual ruler. The Chinese invaded Tibet in 1950 and eventually removed the Buddhists from power. The Dalai Lama went into exile in India in 1959. Gene R. Thursby

See also **Asia** (Way of life in Central Asia); **Buddhism; Dalai Lama; Painting** (Indian painting); **Tibet.**

Lamar, *luh MAHR,* **Lucius Quintus Cincinnatus,** *LOO shuhs KWIHN tuhs SIHN suh NAT uhs* (1825-1893), a Mississippi statesman and politician, worked for good feeling between the North and the South after the Civil War. In 1861, he had urged the South to withdraw from the Union. He held Confederate diplomatic and military posts during the war. But, in 1874, Lamar attracted national attention with his tribute to the late Senator Charles Sumner of Massachusetts. Southerners had hated Sumner for his harsh policy toward them.

Lamar served in the U.S. House of Representatives from 1873 to 1877, and in the U.S. Senate from 1877 to 1885. He served as secretary of the interior from 1885 to 1888, and then was appointed associate justice of the U.S. Supreme Court. Lamar was born in Putnam County, Georgia. Richard N. Current

Lamarck, *luh MAHRK,* **Chevalier de,** *SHEHV uh LIHR duh* (1744-1829), was a French biologist and botanist. He

was one of the first scientists to propose a theory of biological evolution. Lamarck was also a founder of *invertebrate paleontology* (the study of prehistoric animals without backbones).

Lamarck began his work as a botanist in the late 1760's. In 1779 he published a system of plant classification. In the 1790's, he transferred his interest from botany to zoology and soon developed a system for classifying invertebrate animals.

From his work in botany and zoology, Lamarck concluded that plants and animals change their forms to adapt to their environment, and that these changes are then passed along to their offspring. These ideas influenced Charles R. Darwin in his development of the theory of evolution. Lamarck's theory was disproved by discoveries in genetics in the early 1900's, when it was shown that acquired characteristics of an organism cannot be genetically transmitted to its offspring.

In addition to these studies, Lamarck was the first scientist to try to forecast the weather. He published an annual meteorological report from 1799 to 1810. It is said that he was responsible for the names of the various cloud types: *cirrus, stratus, cumulus,* and *nimbus.*

Lamarck was born Jean Baptiste Pierre Antoine de Monet in Bazentin, Picardy. He inherited the title Chevalier de Lamarck from his father. Lamarck studied briefly for the priesthood, then served as an army officer during the Seven Years' War (1756-1763). Later, he turned for a short time to medicine. In 1768, he began studying under the noted botanist Bernard de Jussieu. He became conservator of the royal herbarium in Paris in 1788, and he was appointed professor of zoology at the Museum of Natural History there in 1793. In his later years, Lamarck was completely blind, but he continued his work with the assistance of others. Jerry A. Coyne

See also **Darwin, Charles R.; Evolution** (Early theories); **Heredity** (Early ideas about heredity).

Lamartine, *la mar TEEN,* **Alphonse de,** *al FAWNS duh* (1790-1869), was a French writer and statesman. The death of the woman he loved inspired some of his greatest poems. *Poetic Meditations* (1820), his first published collection, was a key work in the development of French romantic literature and won Lamartine fame. In this work, he expressed sadness and a yearning for the past, and told of the consolation he found in religious faith, the hope of immortality, and the memory of his ideal love. He began a vast work symbolically describing humanity's struggle to reach God by suffering and atonement. Only two episodes, *Jocelyn* (1836) and *The Fall of an Angel* (1838), were finished.

Alphonse Marie Louis de Prat de Lamartine was born in Mâcon. He served briefly as provisional chief of state after the Revolution of 1848. He lost his popularity, and he died heavily in debt. Thomas H. Goetz

Lamb is meat obtained from sheep that are less than 1 year old. Lamb is a red, tender meat with a delicate flavor. It is high in food value. It provides a good source of protein and B vitamins and is rich in the minerals phosphorus and iron. Lamb is popular in Australia, Britain, Greece, New Zealand, and many other countries. People in the United States, however, eat very little lamb. Meat from sheep over 1 year old is called *mutton.*

In the United States, the U.S. Department of Agriculture (USDA) grades lamb for quality based on the age, shape, and fatness of the *carcass.* The carcass is the part of the butchered animal that remains after the skin, head, feet, and internal organs have been removed. The grade is stamped on the carcass. USDA grades for lamb are, from the highest to the lowest, prime, choice, good, utility, and cull. Supermarkets generally sell only prime and choice grades of lamb.

The lamb carcass is divided into seven wholesale cuts: leg, loin, flank, rack, breast, shoulder, and foreshank. Grocers may divide these wholesale cuts into smaller pieces for sale to consumers. Roasts, chops, and steaks are cut from the leg, loin, and rack. These tender cuts should be roasted or broiled. Small chops, however, may be pan fried. Many other lamb cuts are less tender and should be *braised* (cooked by moist heat in a covered pan) or cooked in liquid. Donald H. Beermann

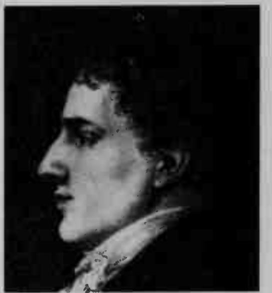
See also **Easter** (The lamb); **Meat; Mutton; Sheep.**

Lamb, Charles (1775-1834), was an English author. He became famous for his informal, personal essays and his highly individual and penetrating literary criticism. Lamb used the pen name *Elia* for many of his essays.

His life. Lamb was born in London. His only formal education was at a London school called Christ's Hospital. The poet Samuel Taylor Coleridge was also a student there, and he and Lamb became close friends. In 1792, Lamb went to work as a clerk for the East India Company. He worked for the firm until his retirement on a pension at the age of 50. Lamb never married. He lived with his sister Mary, and he took loving care of her even during periods when she was mentally unbalanced.

His essays. Lamb's reputation rests on his essays and his literary criticism. But he also wrote a few undistinguished poems and two unsuccessful plays. His farce *Mr. H.* failed miserably at its first performance in 1806, and Lamb joined the audience in hissing his own play. Lamb's best and most popular essays appeared from 1820 to 1825 in *The London Magazine.* They were collected in two volumes known as *Essays of Elia* (1823) and *The Last Essays of Elia* (1833). Lamb's literary and dramatic criticism appears in his essays and in his notes to a collection of excerpts from Elizabethan plays. The notes and excerpts were published as *Specimens of English Dramatic Poets Who Lived about the Time of Shakespeare* (1808). In one of his essays, Lamb argued that Shakespeare's tragedies should be read, not seen, to appreciate their true greatness.

Lamb's writing reveals much about him—his gentle and whimsical nature, his great capacity for friendship, and his warm humanity. Some of his essays recall his youth. Others are character sketches of eccentric people in whom Lamb found something to like. Many of his essays discuss books and the theater, both of which he loved.



Lithograph by Robert Hancock; National Portrait Gallery, London

Charles Lamb

The titles of some of Lamb's essays show the range of his interests—"Poor Relations," "Mrs. Battle's Opinions on Whist," "My First Play," "Dream Children," "A Bachelor's Complaint of the Behaviour

of Married People," and "A Dissertation Upon Roast Pig." Even subjects that seemed ordinary came to life through his original, sympathetic point of view. In his essays, Lamb stayed close to common realities—"sun, and sky, and breeze, and solitary walks, and summer holidays, and the greenness of fields and the delicious juices of meats and fishes, and society, and the cheerful glass, and candlelight, and fireside conversations." Behind Lamb's warmth and humor lay robust common sense. He scorned what he called "the nambypamby." For an example of Lamb's verse, see **February** (Quotations).

Close friendships with such writers as Coleridge, William Wordsworth, Robert Southey, and William Hazlitt made Lamb part of the romantic movement of the early 1800's. Yet Lamb loved city life, which his close friends among the romantic poets generally shunned. He could also make fun of the solemnity of much of Wordsworth's poetry. When he called Coleridge "an archangel, a little damaged," and said that "he had a hunger for eternity," Lamb expressed what other critics might have taken a page to say. In his criticism of William Shakespeare and other dramatists, Lamb tried to get at the deepest realities of life and art.

Mary Ann Lamb (1764-1847), Charles's sister, fatally stabbed their mother in 1796 during a fit of temporary insanity. She was placed under Charles's guardianship, even though he was only 21.

When Mary was well, she was affectionate and intelligent. She worked with Charles in writing three books for children. The most famous is *Tales from Shakespeare* (1807). In retelling the stories of Shakespeare's plays, Charles wrote the tragedies and Mary wrote the comedies. Their other books for children include a collection of stories called *Mrs. Leicester's School* (1807), *The Adventures of Ulysses* (1808), and *Poetry for Children* (1809). Mary was born in London. Frederick W. Shilstone

Additional resources

Aaron, Jane. *A Double Singleness: Gender and the Writings of Charles and Mary Lamb.* Oxford, 1991.
Lucas, Edward V. *The Life of Charles Lamb.* 2 vols. 1905. Reprint. Reprint Services, 1992. The standard biography.

Lamb, Willis Eugene, Jr. (1913-), an American atomic physicist, shared the 1955 Nobel Prize with Polykarp Kusch. Working independently, they discovered slight deviations from the Dirac theory on the behavior of the hydrogen atom (see **Dirac, Paul Adrien Maurice**). Lamb was cited for his discoveries of the hyperfine structure of the hydrogen spectrum.

Lamb was born on July 12, 1913, in Los Angeles. He has taught at the University of California; Columbia, Stanford, Harvard, Oxford, and Yale universities; and the University of Arizona. Richard L. Hilt

Lamb's-quarters is a tall weed related to beets and spinach. It is found in fields and gardens and along roads in most of North America, Europe, and Asia. The plant ranges in size from 1 foot (30 centimeters) to 10 feet (3 meters). Tiny greenish flowers grow in small clusters on the upper part of the stem. The weed is also called *pigweed* or *goosefoot.* It is a nuisance to farmers because the seeds become mixed with grain seeds. The leaves can be cooked and eaten. Anton A. Reznicek

Scientific classification. Lamb's-quarters belongs to the goosefoot family, Chenopodiaceae. Its scientific name is *Chenopodium album.*

Lame Duck Amendment is a popular name for Amendment 20 to the United States Constitution. It was passed in 1933. This amendment provides that the president's term of office begins on January 20 instead of March 4. It also provides that the terms of senators and representatives begin on January 3 following their election in November, and that a new session of Congress would open on this day. This moved the date an elected official takes office closer to the date of his or her election.

The amendment was designed to shorten the time an outgoing president and member of Congress could be a "lame duck"—that is, a public official who continues to serve with diminished power because he or she is soon to leave office. Peter Woll

See also **Constitution of the United States** (Amendment 20).

Lamentations is a book of the Hebrew Bible, or Old Testament, that mourns the destruction of Jerusalem and the Temple in 587 or 586 B.C. According to tradition, Jeremiah, the prophet of the destruction, wrote this book. However, numerous scholars believe that the content of Lamentations does not reflect the views of Jeremiah.

All five chapters of Lamentations are written in verse. The first four chapters are alphabetic acrostics, with each stanza (or three stanzas in chapter 3) beginning with a letter in order of the Hebrew alphabet. The first four chapters relate the dreadful conditions brought about by the destruction and mourn the degradation of Jerusalem. The author attributed these problems to God's punishment of the people for their sins. However, despite widespread despair, the author holds out hope for God's salvation. The fifth chapter of Lamentations ends with a plea for God to forgive and restore Israel.
Carol L. Meyers

See also **Tishah be-av; Jeremiah, Book of.**

Lamer, *lah MAIR,* **Antonio** (1933-), was chief justice of the Supreme Court of Canada from 1990 to 2000. He was appointed by the government headed by Prime Minister Brian Mulroney. Lamer had originally been appointed to the Supreme Court as a *puisne* (associate) judge by Prime Minister Pierre Elliott Trudeau in 1980. As a puisne judge, Lamer gained a reputation as a legal reformer, especially in the field of criminal justice. He also took a liberal approach to the Canadian Charter of Rights and Freedoms, Canada's bill of rights.

Lamer was born on July 8, 1933, in Montreal. In 1956, he earned a law degree from the University of Montreal. He became a lawyer in 1957. From 1967 to 1969, Lamer taught criminal law and criminology at the University of Montreal. In 1969, he was appointed to Quebec's superior court. He became vice chairman of the Law Reform Commission of Canada in 1971 and chairman of the commission in 1976. In 1978, he was appointed to Quebec's court of appeal. Peter H. Russell

See also **Supreme Court of Canada.**

Laminated glass. See Glass (Specialty glasses).

Laminating, *LAM uh NAY tihng,* is a process of permanently bonding together two or more pieces of wood or other materials with glues, pressure, and sometimes heat. Large laminated beams and arches are manufactured by assembling multiple layers of short pieces of wood with their grains running parallel to one another.

The ends of the individual pieces of wood in adjacent layers are *staggered*—that is, they are not even with one another. Plywood is produced by assembling *veneers* (thin sheets of wood) with the grains of adjacent layers at right angles to one another. Rearrangement of grain orientation before lamination gives plywood more uniform strength and better dimensional stability than the wood from which it is made. Jim L. Bowyer

See also **Plastics** (Making plastic products); **Plywood.**

Lammergeier, *LAM uhr GY uhr,* is one of the largest vultures of the mountain regions of Africa, Asia, and Europe. It measures from 37 to 46 inches (94 to 117 centimeters) long and has a wingspread between 9 and 10 feet (2.7 to 3 meters). The lammergeier feeds on wounded, sick, or dead animals. It often breaks open bones by dropping them on rocks from the air. The lammergeier's wings are dark with white streaks. The bird is also called the *bearded vulture* because of its black "beard," which contrasts with its orange neck and breast.



WORLD BOOK illustration by John Rignall, Linden Artists Ltd.

The lammergeier, a large vulture with distinctive light and dark coloring, has a "beard" of black feathers under its bill.

Scientific classification. The lammergeier is in the family Accipitridae. It is *Gypaetus barbatus.* Richard D. Brown

LaMoore, Louis Dearborn. See L'Amour, Louis.

L'Amour, *luh MOOR,* **Louis,** *LOO ee* (1908-1988), was a popular American author known for his exciting novels about Western frontier life in America. L'Amour's stories have been praised for their historical accuracy and detailed descriptions of Western wildlife and geography. He is also known for his sensitive portrayals of American Indians and Mexicans. A number of L'Amour's novels place a high value on family ties. Many of these stories feature three fictional pioneer families named Sackett, Talon, and Chantry.

Louis Dearborn L'Amour (originally spelled LaMoore) was born in Jamestown, N.D. He left home as a teenager and wandered for many years throughout the West, working at a variety of jobs. Encouraged by friends, he began to write down stories he had heard from his grandfather about Indian fighting and the Civil War. L'Amour's first novel, *Westward the Tide* (1950), was followed by the popular *Hondo* in 1953. His other novels include *The Daybreakers* (1960), which introduced the Sackett family; *Bendigo Shafter* (1979); *The Lonesome Gods* (1983); and *The Haunted Mesa* (1987). The autobiographical *Education of a Wandering Man* was published in 1989, after his death. Arthur R. Huseboe

Lamp is any device made to produce light. It ranks as one of the most important inventions. Since the invention of the lamp thousands of years ago, people have not had to depend entirely on the sun for light. Lamps enable people to work and to take part in countless other activities by artificial light.

Through the centuries, people have made many kinds of lamps. But all of them have been one of three basic types: (1) fat or oil, (2) gas, or (3) electric. Today, people use electric lamps almost entirely. Some people keep other kinds in case electricity is not available.

Fat or oil lamps produce light by burning fat, grease, oil, or wax as fuel. These lamps have a wick that performs two functions. The wick serves as a place for the flame to form, and it draws the fuel up to the flame by *capillary* action (see **Capillarity**).

The first lamps were fat lamps, which prehistoric people made from sea shells or hollowed-out stones. They used pieces of grasslike plants called *rushes* as wicks and burned animal fat as fuel in these lamps.

The ancient Egyptians also made stone lamps. But the Egyptian lamps burned oil and had cotton wicks. The ancient Greeks and Romans made lamps from bronze or pottery. Early Greek lamps looked like saucers and burned olive oil or the oil of other plants. The wick simply floated on the oil. Later Greek lamps had a groove at the edge of the saucer to hold the wick. Some Roman lamps resembled a teakettle. The body of the "kettle" held the oil, and the "spout" held the wick.

Candles are a type of fat lamp. The earliest candles were made by coating a wick with wax and pitch. Later, candlemakers used *tallow,* a waxy substance obtained from animal fat. The best candles consisted of beeswax or *paraffin,* a wax obtained from petroleum. Most candles cost more than other types of lamps. Inexpensive lamps called *rushlights* burned like candles. They were made by dipping dried rushes into animal fat. See **Candle.**

A type of oil lamp called a *cruise* appeared in Scotland during the Middle Ages. This lamp consisted of an iron pan that had a trough sticking out from it. The trough held the wick. Many cruises had a second trough beneath the first to catch any dripping oil. The American colonists made cruises called *Betty lamps.* The colonists usually burned fish oil or whale oil in these lamps.

Through the years, people added reflectors to lamps to *diffuse* (spread out) or concentrate the light. Otherwise, few improvements occurred in lamps until the late 1700's. In the 1780's, a Swiss chemist named Aimé Argand invented a lamp with the wick bent into the shape of a hollow cylinder. Such a wick allowed air to reach the center of the flame. As a result, the Argand lamp produced a brighter light than other lamps did. Later, one of Argand's assistants made another improvement after discovering that a flame burns better inside a glass tube. His discovery led to the invention of the *lamp chimney,* a clear glass tube that surrounds the flame. During this period, whale oil and *colza oil,* an oil from

the rape plant, became important fuels for lamps. The birth of the oil industry in the mid-1800's led to the widespread use of kerosene, a petroleum product, as lamp fuel.

Gas lamps produce light by means of one or more small gas flames. These lamps need no wick. The gas flows from the lamp through a small opening and then burns after mixing with air. Gas lamps burn many kinds of gas, including acetylene, butane, coal gas, natural gas, producer gas, and water gas.

William Murdock, a Scottish engineer, developed the first commercially important gas lamps. In 1792, Murdock lit his home with gas lamps that burned coal gas. By the early 1800's, gas lamps had come into use as street lamps in London and other cities. Gas lamps served as important sources of light until the late 1800's, when electric lamps began to replace them.

The gas lamp had one chief problem, the open gas flame. The flame often flickered and produced uneven light. Some gas lamps had a glass chimney, like that of an Argand lamp, to help control the flickering. In the late 1800's, a device called a *mantle* solved the problem. A mantle is a loosely woven cloth bag that is soaked with a chemical substance. The cloth quickly burns away in the lamp, and the chemical glows steadily as the gas burns around it. Most modern gas lamps, including the

Lamps through the ages

Throughout history, people have used many kinds of lamps. Until electric lights were developed in the late 1800's, all lamps produced light by burning fuels, such as fat, gas, or oil. The most important types of fuel-burning lamps are shown below.



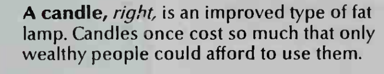
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A hollowed-out stone was one of the first lamps. Ancient peoples used plant fibers as a wick to burn fat placed in the hollow.



Wadsworth Atheneum, Hartford, Conn. Gift of J. P. Morgan

A Roman lamp made of bronze, *above,* burned oil in its spout. This lamp could stand on a table or be hung by a chain.



A candle, *right,* is an improved type of fat lamp. Candles once cost so much that only wealthy people could afford to use them.



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WORLD BOOK photo

The kerosene lamp became popular in the mid-1800's. The lamp, *above,* has a reflector to provide as much light as possible.



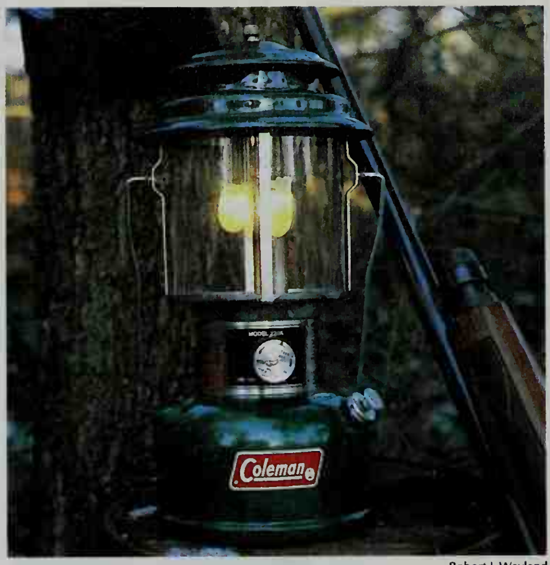
Museum of Fine Arts, Boston, M. & M. Karolik Collection

The Argand lamp was invented in the 1780's. It had a hollow wick so that more air reached the flame, making a brighter light.



British Crown Copyright. Science Museum, London

The gas lamp lit streets and homes. The above lamp has a glass shade that softens its light.



Robert J. Wayland

A gasoline lantern gives campers a bright, portable light. Such fuel-burning lamps provide light in places that have no electricity, or during periods of electric power failure.

portable gas and liquid fuel lamps used by campers, have mantles.

Electric lamps produce light by means of electric energy. The American inventor Thomas A. Edison developed the first practical electric lamp in 1879. Electric lamps came into widespread use in the early 1900's and have replaced other types of lamps for almost every purpose. Electric lamps produce more and better light than the earlier lamps. They are also less expensive and easier to use. For more information on electric lamps, see the articles on **Electric light** and **Lighting**.

Ronald N. Helms

See also **Invention** (Inventions that give people light); **Lighting** (Lighting problems; Lighting devices).

Lampblack. See **Carbon.**

Lampman, Archibald (1861-1899), was one of the leading Canadian poets of the late 1800's. Lampman's importance lies in his effort to capture a uniquely Canadian landscape in his poetry. He saw such works as the contribution he could make to the development of a distinctly Canadian literature.

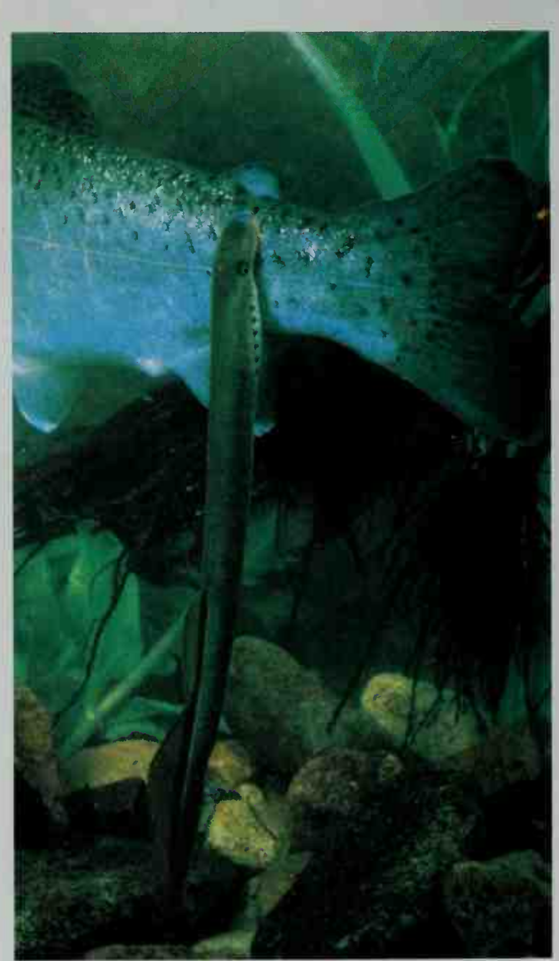
Lampman's poetry reflects the influence of William Wordsworth and other English romantic poets. Like Wordsworth, Lampman believed people were spiritually exhausted by urban industrialism and needed to renew themselves by solitary communion with nature. Lampman published three collections of poems—*Among the Millet, and Other Poems* (1888), *Lyrics of Earth* (1895), and *Alcyone* (1899).

Lampman was born in the village of Morpeth, Ont., near Blenheim. He worked for the Canadian Post Office in Ottawa. However, he was a dedicated naturalist and his canoeing expeditions into the wilderness and walks into the countryside provided him with the experience for his poems. Lampman suffered from rheumatic fever as a child, and as an adult his health was poor. He died of heart disease at the age of 38. Rosemary Sullivan

Lamprey, *LAM pree,* is a fish with a long eellike body. Scientists consider the lamprey one of the least developed *vertebrates* (animals with backbones). Unlike most other fishes, the lamprey has no bony skeleton. It has a backbonelike *notochord* made of rubbery tissue called *cartilage.* The lamprey has fins on its back but not on its sides. Its round mouth has no jaws but can create strong suction. Adults of some species develop horny teeth. Such an adult attaches itself to other fishes by sucking with its mouth and clamping with its teeth. It feeds on its victims' blood and other body fluids.

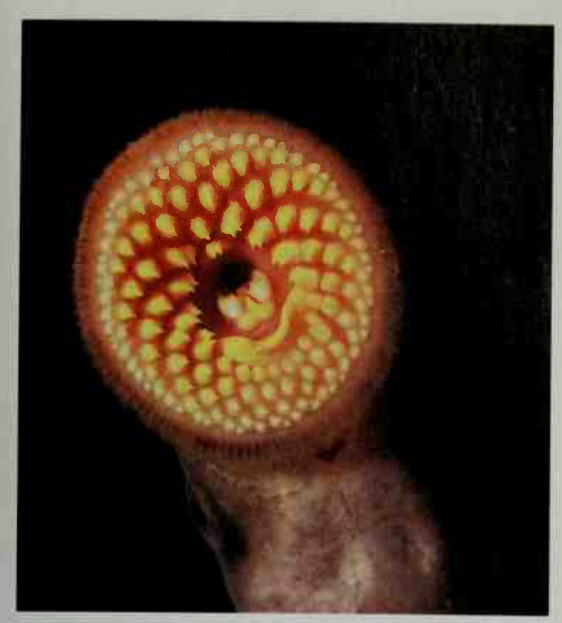
Body. The lamprey's skin is smooth, shiny, and scaleless. *Brook lampreys,* which live in small streams throughout temperate parts of Europe, Asia, and North America, grow about 8 inches (20 centimeters) long. Larger *species* (kinds) live in rivers and lakes.

Sea lampreys, which may grow as much as 3 feet (91 centimeters) long, live in the North Atlantic and North Pacific oceans. All lampreys are dull colored, ranging from light-tan to mottled-brown or bluish-black. They do not have true bony teeth. Their teeth are horny developments that grow from the inner surface of the mouth.



Hans Reinhard, Bruce Coleman Inc.

The lamprey attaches itself to a fish and sucks out blood and other body fluids. The small brook lamprey, *above,* lives in streams in Asia, Europe, and North America.



© Heather Angel

The lamprey's mouth is especially suited for sucking fluids from the bodies of other fish. Horny teeth on the inside of the mouth help the lamprey attach itself to a victim. Similar teeth on the lamprey's tongue rip open the skin of its victim.

Habits. Lampreys spawn in clear, freshwater streams. The male and female dig a shallow nest in the gravel or pebbles of the stream bottom. The female deposits the eggs in the nest. The adults die after spawning. *Larval* (young) lampreys are called *ammocoetes.* They are blind and toothless, and look like worms. The ammocoetes live in the sand and mud of the stream bottom for several years. Then they change into adults, with eyes and teeth.

Parasitic lampreys feed by attaching themselves to fishes, scraping a hole through the skin, and sucking out blood and other body fluids. The adults of the *nonparasitic* lampreys do not eat. Their digestive organs degenerate, and they live only until the spawning season. Then they spawn and die.

Destructiveness. Large sea lampreys rank as the most destructive to fishes. As adults, they descend to the sea and prey on large fishes. But some sea lampreys that spawned in streams flowing into Lake Ontario once entered the upper Great Lakes through the Welland Canal. Later generations of these lampreys no longer descend to the sea, but prey on lake trout, whitefish, and other large lake fishes. By the late 1950's, they had killed most of the lake trout in the Great Lakes. Scientists tried to control the lampreys by putting electric *weirs* (fences) across streams to prevent the lampreys from spawning. But the weirs were costly and difficult to maintain. Researchers discovered that a chemical called TFM would kill lampreys but would not harm other fish in the rivers. The treatment of streams with this chemical caused a sharp decline in the number of lampreys by the mid-1960's. Wildlife officials then stocked the lakes with coho salmon, lake trout, and other fishes.

At one time lampreys were used for food in New England, and smoked "lamper eels" were considered a delicacy. Henry W. Robison

Scientific classification. Lampreys belong to the lamprey family, Petromyzontidae. The lamprey found in the Great Lakes is *Petromyzon marinus.*

See also **Hagfish.**

Lan-chou. See **Lanzhou.**

Lancaster was the name of a branch of the Plantagenet royal family that ruled England from 1399 to 1461. The House of Lancaster also ruled in 1470 and 1471.

John of Gaunt, fourth son of King Edward III, founded the dynasty when he became Duke of Lancaster through his marriage to Blanche of Lancaster. The House of York stemmed from Gaunt's older brother Lionel and younger brother Edmund. Gaunt's son became King Henry IV in 1399, taking the throne away from his childless cousin, Richard II, and ignoring Lionel's great-grandson, the Earl of March. This act led to the Wars of the Roses between the House of Lancaster and the House of York, which broke out more than 50 years later.

Henry IV's oldest son succeeded him as Henry V. Through his conquests in France, Henry V became one of the most famous warrior kings of England. Henry V died in 1422, leaving the throne to his baby son, Henry VI. All that his father won, the well-intentioned but ineffective Henry VI lost. In 1461, Edward IV of the House of York was proclaimed king and defeated Henry VI's forces at the Battle of Towton.

Henry regained the throne for six months in 1470-1471 but lost it and was imprisoned. His only son, Edward, was killed in 1471, and Henry was probably murdered three weeks later. Thus, the direct line of the House of Lancaster came to an end. Ralph A. Griffiths

See also **Henry IV** (of England); **John of Gaunt; Wars of the Roses.**

Lancaster, Pennsylvania (pop. 56,348; met. area pop. 470,658), is the commercial center of Lancaster County, one of the richest farming regions in the United States and a popular tourist area. Lancaster is also an important manufacturing city. It lies along the Conestoga River in southeastern Pennsylvania. For the location of Lancaster, see **Pennsylvania** (political map).

Lancaster's chief products include aluminum, artillery farm equipment, flooring, fuses, industrial power tubes, pharmaceuticals, and printed materials. The city is the trading center for the region's farm products, which include cattle, corn, poultry, and tobacco.

Lancaster has many historical buildings. The city's Fulton Opera House was built in 1852 and is one of the oldest continuously used theaters in the United States. Wheatland, the estate of U.S. President James Buchanan, is in Lancaster. The city is also the home of Franklin & Marshall College and Lancaster Theological Seminary.

Amish and Mennonite settlers left Germany and—with members of other religious groups—founded Lancaster County in the early 1700's. These and other peoples became known as the *Pennsylvania Dutch* (see **Pennsylvania Dutch**). The settlers developed the area's rich farmland. They also invented the Conestoga wagon and the Pennsylvania rifle. Lancaster was chartered as a borough in 1742 and incorporated as a city in 1818.

During the Revolutionary War in America (1775-1783), Lancaster provided food and guns for the Continental Army. It was the capital of the United States for one

day, Sept. 27, 1777, when Congress moved from Philadelphia to York. Lancaster served as the capital of Pennsylvania from 1799 to 1812. The Lancaster Turnpike, the nation's first important turnpike, was opened between Lancaster and Philadelphia in 1794. Lancaster has a mayor-council form of government and is the seat of Lancaster County. John H. Brubaker III

See also **Pennsylvania** (picture).

Lancelet. See **Amphioxus.**

Lancelot, *LAN suh laht,* **Sir,** was a great knight in medieval legends of King Arthur's Round Table and the central figure in several romances. Lancelot won fame for his bravery and skill in combat and was Arthur's favorite knight. But he had a love affair with Queen Guenevere, Arthur's wife, that led to his downfall. The scandal that resulted from their affair contributed to the breakup of the Round Table.

Lancelot was the son of Ban, the king of Brittany. The Lady of the Lake, a woman with magic powers, took Lancelot as an infant to her castle at the bottom of a lake. After he reached manhood, the Lady of the Lake brought him to Arthur's court. Lancelot had a brief affair with Elaine of Astolat, a British princess. They had an illegitimate son, Galahad, who became a famous knight of the Round Table.

Along with many other knights, Lancelot searched for the *Holy Grail,* which is often depicted as the cup or dish that Jesus Christ used at the Last Supper. Because he was morally imperfect, Lancelot did not find the Holy Grail. But his son, Sir Galahad, did find it.

Lancelot and Guenevere had fallen in love at Arthur's court. After Arthur discovered their affair, the lovers fled to Lancelot's castle, Joyous Garde. Lancelot killed several of his fellow knights after they found him with the queen. Later, Lancelot returned Guenevere to Arthur and left England. Arthur pursued Lancelot to France but went back to England after learning that Modred had seized his kingdom. According to various accounts, Modred was either Arthur's nephew or his son. Lancelot returned to Britain after Arthur's death and learned that Guenevere had become a nun. He became a religious hermit and died shortly after Guenevere did.

Illustration (about 1300) from a French manuscript; Bodleian Library, Oxford, England

Sir Lancelot was a member of King Arthur's legendary Round Table. During his quest for the Holy Grail, Lancelot met a hermit living in a hut in a tree.

Lancelot first appeared as an important character in a French romance written about A.D. 1180 by Chrétien de Troyes. Sir Thomas Malory, an English writer, gave the fullest account of Lancelot in English in *Le Morte Darthur* (about 1470). Lancelot was also a chief character in *Idylls of the King,* a series of poems by the English poet Alfred Lord Tennyson. Edmund Reiss

See also **Round Table.**

Lancewood is a tough, heavy wood used for such objects as archery bows, fishing rods, and tool handles. It comes from two types of trees that grow in tropical America. The scientific names for these trees are *Oxandra lanceolata* and *Calycophyllum candidissimum.* Only the pale-yellow sapwood of the trees is used commercially. Jim L. Bowyer

Land. See **Earth** (The lithosphere); **Real estate; Soil.**

Land, Edwin Herbert (1909-1991), an American inventor, scientist, and business executive, invented the Polaroid camera, the first practical instant camera. An instant camera produces a photograph in seconds.

Land held more than 500 patents. In 1934, he patented *polarized light filters,* which reduce glare from harsh light sources and strong reflections on glass and similar surfaces. In 1937, Land founded the Polaroid Corporation to manufacture the filters. Polarized filters found uses in automobile headlights, sunglasses, and cameras.

In 1947, Land demonstrated the first practical process to create instant photographs. Land's first Polaroid camera produced black-and-white photos on special film inside the camera in less than a minute. It became available to the public in 1948. In 1963, Land created color instant film and a new line of Polaroid cameras. The cameras used a simple film pack, and the film developed outside the camera, so that a photographer did not have to wait before taking another picture. In 1972, Land introduced the Polaroid SX-70 camera and a new type of film pack. The camera automatically ejected each picture, and the image developed in open light.

Land was born on May 7, 1909, in Bridgeport, Connecticut. He served as president of Polaroid until 1975 and as its chairman of the board until 1982. He died on March 1, 1991. David F. Silver

See also **Photography** (Instant processing); **Polarized light** (Polarizing materials).

Land-grant university is a school endowed under the Morrill, or Land-Grant, Act of 1862. Congress granted every state 30,000 acres (12,141 hectares) of land for each senator and representative it had in Congress. The land was to be sold, the proceeds invested, and the income used to create and maintain a college for agriculture and the mechanical arts.

For several years, people had clamored for colleges to teach the finer points of farming and manufacturing. Finally the Land-Grant Act, sponsored by Representative Justin S. Morrill of Vermont, was passed. The act added military science and tactics to the proposed curriculum. Altogether, the states and territories received 11,367,832 acres (4,600,398 hectares) of land. Congress added money to its gifts through the Second Morrill Act of 1890 and an amendment in 1907. Today, all states and Puerto Rico receive federal grants to help support land-grant universities.

Not all the states used the land-grant money as

planned by the act. Thirty states, mainly in the Middle West and South, set up new agricultural and mechanical colleges. Eighteen gave the money to state universities to finance new agricultural and mechanical departments. Three gave the money to private colleges. Also, most of the states were unable to sell all the lands given them. The land they did sell was sold at a price so low that the states made almost no money.

But the educational value of the land-grant idea has been priceless. As a result of this program, old colleges have been able to expand, and new colleges have been created. Land-grant schools include such well-known institutions as the University of California and the University of Illinois. Douglas Sloan

Land Management, Bureau of, is a United States government agency that administers about 270 million acres (110 million hectares) of public land. Most of this land lies in the Western States and Alaska, and has never been privately owned. The land provides food for livestock, supplies forest products and minerals, offers opportunities for outdoor recreation, and is a natural home for wildlife. The bureau is responsible for planning uses for the land, and for managing it in the public interest. Pieces of land are sometimes offered for sale when such sales are regarded in the national interest.

The Bureau of Land Management was established in 1946 as part of the Department of the Interior. It took over the functions of two previous agencies, the General Land Office and the U.S. Grazing Service. The bureau has headquarters in Washington, D.C., and offices in the Western States and Alaska.

Critically reviewed by the Bureau of Land Management

Land reform is the breakup of large landholdings and the redistribution of the land to farmers who have little land or none. Land reform may be carried out by a government or by the leaders of a revolutionary movement. Governments usually undertake land reform to reduce social and political tensions. Revolutionists may favor land reform to gain support for their revolution. Land reform may increase agricultural output by causing the land to be farmed more intensely.

A government may acquire land for redistribution by *expropriating* it—that is, by taking the land against the will of the owner, sometimes without paying for it. Governments also may buy land from landlords who wish to sell portions of their holdings. Some land reform laws redistribute land by abolishing regulations that limit peasants' ability to own or purchase land. To be successful, land reform often must be accompanied by other measures. These measures include the assurance of indisputable land titles and fair taxes and the provision of technical assistance and affordable loans.

Land reform has been especially important in the less developed countries of Asia and Latin America. In many of these countries, a small number of people have traditionally owned a large percentage of the farmland. In most cases, such a pattern of land ownership originated in past feudal or colonial systems. However, the pattern may be reinforced by modern technological changes and by political practices that favor people who own large amounts of land. Howard Handelman

See also **Mexico** (Agriculture).

Landers, Ann (1918-2002), is the pen name of Esther Lederer, who wrote a popular newspaper column that gave advice and information to readers. She was considered one of the most influential people in the United States. The column was published in over 1,000 newspapers in the United States and other countries.

People wrote to Landers about such matters as family life, health, marriage, and social issues. She consulted attorneys, physicians, psychologists, members of the clergy, and experts in other fields to help answer questions. In her replies, many of which are humorous and light-hearted, Landers also used common sense and personal experience.



Dave Cooper, *Toronto Star*

Ann Landers

Landers's full real name was Esther Pauline "Eppie" Friedman Lederer. She was born on July 4, 1918, in Sioux City, Iowa, and attended Morningside College. Landers began her career in 1955, when she took over the advice column of the *Chicago Sun-Times.* In 1987, she moved the column to the *Chicago Tribune.* Landers wrote several books, including *Ann Landers Talks to Teenagers About Sex* (1963) and *The Ann Landers Encyclopedia from A to Z* (1978). Her twin sister, Pauline Phillips, writes an advice column called *Dear Abby* under the name Abigail Van Buren. Landers died on June 22, 2002. William McKeen

See also **Van Buren, Abigail.**

Landes, Bertha Knight (1868-1943), was the first woman mayor of a major United States city. A Republican, she was mayor of Seattle, Washington, from 1926 to 1928. She served on the city council from 1922 to 1926. She was born on Oct. 19, 1868, in Ware, Massachusetts, and attended Indiana University. After retiring from public service, she became a lecturer and writer.

C. Brewster Coulter

Landis, Kenesaw Mountain, *KEHN ih SAW* (1866-1944), an American judge, served as the first commissioner of professional baseball. During many years as judge of the United States District Court of Northern Illinois, Landis earned a reputation for fairness. In 1907, he won attention by fining the Standard Oil Company of Indiana $29,240,000 for accepting freight rebates.

In 1919, the Chicago White Sox allowed the Cincinnati Reds to "win" the World Series. To protect baseball from further dishonesty and scandal, the club owners appointed Landis commissioner of baseball in 1920. Landis ruled baseball with an iron hand, and the game acquired an unquestionable reputation for honesty. He was elected to the National Baseball Hall of Fame in 1944. Landis was born on Nov. 20, 1866, in Millville, Ohio. Ed Fitzgerald

See also **Baseball** (The Black Sox Scandal).

Landlord. See **Tenant; Lease.**

Landon, Alfred Mossman (1887-1987), was the Republican candidate for president in 1936. He and his running mate, Frank Knox, lost the election to Franklin D. Roosevelt and John Nance Garner.

Landon served two terms as governor of Kansas. He won the 1932 and 1934 elections despite the Democratic

national landslide. Landon's ability to balance the state budget helped bring him the presidential nomination in 1936.



Alfred M. Landon

Landon was born in West Middlesex, Pennsylvania, and graduated from the University of Kansas. In 1912, he and three partners created a company to develop oil wells. Landon became a leader in the petroleum industry. In 1928, he served as chairman of the Republican State Central Committee. Landon's daughter Nancy Landon Kassebaum served in the United States Senate from 1979 to 1997. David E. Kyvig

Landowska, *lan DAWF skuh,* **Wanda** (1879-1959), was a Polish pianist, composer, and harpsichordist. She helped revive interest in harpsichord music in the 1900's.

Landowska was born in Warsaw. She moved to Paris in 1900, where she researched the musical performance practices of the 1600's and 1700's. Landowska became convinced that the harpsichord was the appropriate instrument for music of this period, and she developed modern harpsichord technique.

In the years following her Parisian debut in 1903, Landowska toured internationally, playing both the piano and harpischord in concerts. In 1923, she made her first visit to the United States, performing as a harpsichord soloist with the Philadelphia Orchestra. In 1920's and 1930's, she operated a school near Paris dedicated to the study of early music. She left in 1940 to settle in the United States. When she was 70 years old, Landowska recorded the complete *Well-Tempered Clavier* by Johann Sebastian Bach. Her many writings include the book *Music of the Past* (1909). Lydia Hailparn Ledeen

Landrum-Griffin Act. See Labor movement (Charges of corruption).

Land's End, a cape in Cornwall, is the westernmost point of land in England. It juts into the English Channel where the channel opens into the Atlantic Ocean. For location, see **United Kingdom** (terrain map). Land's End is a granite promontory with cliffs from 60 to 250 feet (18 to 76 meters) high that have been carved into strange shapes by the waves. Longships Lighthouse, on a rock about 1 mile (1.6 kilometers) from Land's End, marks dangerous reefs. M. Trevor Wild

Landscape architecture is a profession that involves the design and development of land for human use and enjoyment. It is concerned with the beauty of natural surroundings as well as practical ways to use land and the objects on it. People professionally trained in this field are called *landscape architects.*

Landscape architects create plans for a wide variety of land development projects. These projects may range from national parks to small city squares, or from multifamily housing developments to gardens for single family homes. Landscape architects may create equipment for a playground or propose a master plan for university expansion. They might plan the layout of a golf course or for an entire new community. They are involved at all levels at which land use decisions are made, from land planning to site design, to land use management.

Land planning. Landscape architects prepare regional land use reports. These reports include environmental impact statements, which evaluate what land is best suited for residential, industrial, transportation, recreation, and conservation purposes (see **Environmental impact statement**). They study such area features as climate, water supply, vegetation, soil composition, and the slope of the land. They attempt to preserve attractive views and historic landmarks, and to avoid erosion, flooding, and air and water pollution. Landscape architects often work with traffic engineers, economists, ecologists, city planners, and public officials.

Site design. After land use has been determined, landscape architects prepare site development plans and supervise construction contractors. They work with architects to fit structures to land forms, making best use of breezes, sunlight, and views. In designing roads, parks, and other sites, they keep mature trees for shade and arrange for proper grading and drainage. They design walls, fences, steps, pavement patterns, and planting arrangements.

Landscape architects try to arrange outdoor facilities so the facilities function smoothly and harmonize with the surroundings. A city plaza, for example, would have sitting places, fountains, and ornamental plants designed to fit well into traffic and building patterns.

Land use management. Landscape architects help park superintendents and other land administrators develop procedures for using land in a way that conserves



© John Fulker, Miller Services

Indoor landscaping creates pleasant surroundings in this shopping mall in Edmonton, Canada. A skylight, palm trees, a fountain, and plants are arranged in a tropical scene.

its productivity and beauty. For example, a landscape architect might prepare a resource management program for forests and waterways, or a restoration plan for land with historic significance.

History. Landscape architecture as a profession dates from the mid-1800's. But as an art, it has been practiced for thousands of years. For example, many Roman homes built between the 400's B.C. and the A.D. 400's had elaborate courtyards. Other early examples include the gardens of ancient Persia (A.D. 200's to 600's) and Japan (A.D. 500's). The Italians designed and built beautiful hillside estates and civic plazas during the 1400's and 1500's. France in the 1600's and 1700's was noted for its magnificent palaces and its city gardens. English designers planned natural-looking country estates during the 1800's.

Many of these early projects were gardens and country estates, and the designers were often called *landscape gardeners.* Frederick Law Olmsted, an American, was the first person to call himself a landscape architect. In the 1850's, Olmsted and Calvert Vaux designed New York City's Central Park. When Olmsted signed these plans, he placed the words *landscape architect* under his name. He saw his job as creating outdoor environments much as architects plan buildings. In 1899, his followers formed the American Society of Landscape Architects, the profession's national organization.

Today, landscape architects are employed as consultants, teachers, or staff members of government agencies. Most of these positions require a professional degree from an accredited university program.

Albert J. Rutledge

Related articles in *World Book* include:

Botanical garden
City planning
Fountain
Le Nôtre, André
National Park System
New Harmony (picture)
New York City (picture: Manhattan's Central Park)
Olmsted, Frederick Law
Paris (picture: Luxembourg Gardens)
Park
Versailles, Palace of

Landslide, in geology, is a mass of earth or rocks that slides down a slope. Two conditions are necessary for a landslide: a steep slope and a weakness in the solid rock beneath the surface of the slope. Earthquakes or heavy rains can trigger landslides. Erosion caused by rivers, waves, glaciers, or construction projects creates the steep slopes necessary for landslides.

Some landslides are large enough to create lakes by damming up rivers. In 1840, an earthquake in Kashmir triggered a landslide on the Indus River and created a lake about 1,000 feet (300 meters) deep and 40 miles (64 kilometers) long. Landslides can be destructive. In 1903, a major landslide in the Canadian coal-mining town of Frank, Alta., buried part of the town and killed 70 people. See **Alberta** (Places to visit; picture).

John G. Anderson

See also **Earth** (Mass movement).

Landsteiner, *LAND* *sty nuhr* or *LAHNT* *shty nuhr,* **Karl** (1868-1943), won the 1930 Nobel Prize for physiology or medicine for his discovery of the main types of human blood—A, B, AB, and O. This discovery made safe blood transfusions possible for the first time. In 1940, Landsteiner and his co-workers, Philip Levine and Alexander Wiener, discovered the Rh blood factor, an important cause of stillbirths. Landsteiner also contributed information on how the body becomes immune to certain disease bacteria. In addition, his research helped lead to the discovery that a virus causes polio.

Landsteiner was born in Vienna, Austria. He moved to the United States in 1922 and was a member of the Rockefeller Institute for Medical Research (now Rockefeller University) from 1922 to 1939. Daniel J. Kevles

See also **Blood** (Blood groups); **Rh factor.**

Lanfranc, *LAN frangk* (1005?-1089), was an important medieval teacher and scholar. He was an adviser to William the Conqueror, the first Norman king of England, and served under him as archbishop of Canterbury.

Lanfranc was born in Pavia, Italy. He became a monk in the Benedictine order at Bec, in Normandy, about

© David R. Frazier

Landscaped gardens are among the many different projects undertaken by landscape architects. Butchart Gardens in Victoria, Canada, *left,* has beautiful flowers, lawns, trees, and ponds.

1042. Lanfranc was head of the monastery school for about 18 years, and achieved distinction as a teacher of theology. Under his leadership, the school became one of the most famous in Europe. Saint Anselm and the future Pope Alexander II were among Lanfranc's students. Lanfranc also wrote several influential books on monastic life and the sacrament of Communion.

In 1070, William appointed Lanfranc archbishop of Canterbury. As archbishop, Lanfranc reformed the guidelines for the marriage of priests, and set up the church's court system in England. William J. Courtenay

Lang, Andrew (1844-1912), was a Scottish scholar and author. Lang wrote a large number of works on a wide variety of subjects. He published poetry, fiction, literary criticism, anthropological studies, translations, children's books, histories, and biographies.

Lang's studies of folklore are probably the most enduring of his works. His book *Myth, Ritual, and Religion* (1887) is an important statement of Lang's theories about the relationship between folklore and mythology. Lang worked with other scholars on translations of the Greek epics the *Iliad* and the *Odyssey.* His translations and critical works on ancient Greek writers made a significant contribution to contemporary interpretations of classical literature. Lang was born on March 31, 1844, in Selkirk, Scotland. Avrom Fleishman

Lang, Fritz (1890-1976), was a motion-picture director who made classic horror and suspense films in both Germany and the United States. Lang first gained recognition in Germany for his silent films about the corruption of society by criminals and mad scientists. The most important of these movies were *Dr. Mabuse, the Gambler* (1922), *Metropolis* (1926), and *Spies* (1928). Lang's first sound film, *M* (1931), describes the search for an insane killer of children.

Lang fled Germany in 1933 rather than direct motion pictures for the Nazis, and he settled in the United States. His best American films all concern a man being pursued by an evil force that drives him to desperation. For example, *Fury* (1936), Lang's first American film, deals with a man threatened by a lynch mob. *The Big Heat* (1953) portrays a man's battle against gangsters. Lang's other American movies include *You Only Live Once* (1937), *The Return of Frank James* (1940), *Man Hunt* (1941), *The Ministry of Fear* (1944), *The Woman in the Window* (1945), and *Rancho Notorious* (1952).

Lang was born on Dec. 5, 1890, in Vienna. He directed his first motion picture in 1919. John F. Mariani

Langdon, John (1741-1819), was a New Hampshire signer of the Constitution of the United States. He actively represented his state at the 1787 Constitutional Convention in Philadelphia and spoke in favor of a strong national government on numerous occasions. Langdon later helped win *ratification* (approval) of the Constitution by New Hampshire.

Langdon was born on June 26, 1741, near Portsmouth, New Hampshire. Before the Revolutionary War in America (1775-1783), he was a successful ship captain and merchant. During the war, Langdon represented New Hampshire in the Second Continental Congress and was speaker of the New Hampshire legislature. He also built ships for the Continental Navy. Langdon served as chief executive of New Hampshire in 1785, 1786, 1788, and 1789. From 1789 to 1801, Langdon served as a U.S. senator. He then returned to state politics. Langdon acted as speaker of the New Hampshire legislature from 1803 to 1805. He was governor of New Hampshire from 1805 to 1809 and from 1810 to 1812. Jere Daniell

Lange, *LAWNG ee,* **David Russell** (1942-), served as prime minister of New Zealand from 1984 until 1989, when he resigned from office. He took office after the Labour Party, which he headed, defeated the governing National Party in the 1984 elections. His party won again in 1987, and Lange remained prime minister. A moderate Socialist, Lange favored some government and some private ownership of industries. In foreign policy matters, he supported greater independence from the United Kingdom and the United States. Under Lange, the government established a policy that excluded from New Zealand ports and territorial waters all ships powered by nuclear fuel or armed with nuclear weapons. In 1985, a U.S. destroyer was denied access to a New Zealand port after U.S. officials refused to announce whether or not the ship carried nuclear weapons.



New Zealand Embassy

David R. Lange

Lange was born on Aug. 4, 1942, in Auckland. He earned law degrees from the University of Auckland in 1966 and 1970. For several years, he worked as a lawyer, often taking the cases of people who could not afford to pay. He first won election to Parliament in 1977. He was the leader of the Labour Party from 1983 until 1989.

Andrew Stone

Lange, Dorothea, *DAWR oh THEE uh* (1895-1965), was an American photographer known for her pictures of migratory farmworkers of the 1930's. Lange's photographs honestly and sympathetically portray families who were victims of drought and the Great Depression. Her pictures, which appeared in several newspapers and magazines, helped create support for government relief programs for migrant workers. Many of Lange's photographs were published in her book *An American Exodus: A Record of Human Erosion* (1939).

Lange was born on May 26, 1895, in Hoboken, New Jersey, and studied photography at Columbia University. In 1919, she opened a portrait studio. During World War II (1939-1945), Lange photographed Japanese-Americans whom the government moved to relocation camps from their homes on the West Coast. After the war, she photographed Mormon towns, life in California, and other subjects. She also took photographs in Asia, Egypt, Ireland, and South America. John G. Freeman

See also Photography (picture: Documentary photographs).

Langland, William (1330?-1400?), wrote *Piers Plowman,* a great English poem of the Middle Ages. Scholars know little about Langland's life, but they believe he was born in Shropshire. In the late 1300's, Langland wrote three versions of *Piers Plowman.* All of the versions use *alliteration* (words that begin with the same sound) instead of rhyme and are written in Middle English, the

version of the language that was spoken during Langland's time.

The main theme of *Piers Plowman* is the need to reform England spiritually through Christian faith and love. The poem is a complex religious allegory in which each character represents an abstract quality or a type of person. The main character, Will, represents the will of every person who wants salvation. Piers, another character, modeled on a humble worker, symbolizes all true ministers of God. The action consists of Will's quest for Truth. Will has nine dreams, in which most of the action occurs. The poem comments shrewdly on many topics and problems of the time. Although deeply religious, it is particularly critical of the religious establishment of its day. Paul Strohm

Langley, Samuel Pierpont (1834-1906), was an American astronomer, physicist, and pioneer in aeronautics. His interest in *aerodynamics* (the motion of gases around a body) led him to experiment with heavier-than-air flying machines. His power-driven models made some flights of about $\frac{1}{2}$ mile (0.8 kilometer) in 1896. The U.S. government later gave Langley $50,000 to build a passenger-carrying "aerodrome." This machine twice was launched from a houseboat on the Potomac River in 1903. Both tests failed, but one using a smaller model succeeded. The second full-sized model test was made in December 1903, shortly before the Wright brothers' epoch-making flight at Kitty Hawk, North Carolina.

In 1914, eight years after Langley's death, several changes were made in his "aerodrome" machine, and it was flown at Hammondsport, New York, by Glenn H. Curtiss. The United States Navy honored Langley by naming its first aircraft carrier after him. It was sunk in the Java Sea early in 1942. A second carrier named *Langley* served later in World War II. The Langley Air Force Base in Virginia is also named after him.

Langley was born in Roxbury, Massachusetts, and attended Boston Latin School. He spent several years studying architecture and engineering before turning to astronomy. His inventions included the *bolometer,* a device that measures the sun's radiation (see **Bolometer**).

From 1867 to 1887, Langley was professor of physics and astronomy, and director of the Allegheny Observatory, at the Western University of Pennsylvania in Pittsburgh. He served as secretary of the Smithsonian Institution from 1887 until his death. While in this office, he established the National Zoological Park and the Astrophysical Observatory. His writings include *Experiments in Aerodynamics* (1891) and *The Internal Work of the Wind* (1893). Bobby H. Johnson

See also **Airplane** (Powered flight).

Langley Air Force Base, Virginia, is the headquarters of the Air Combat Command (ACC) of the United States Air Force. The ACC, which was created in an Air Force reorganization in June 1992, provides combat forces for *joint* (interservice) commands in wartime. Langley was the headquarters of the Tactical Air Command, which was eliminated in the reorganization.

Langley covers about 5,400 acres (2,200 hectares) north of Hampton, Virginia. The base was established in 1916. It was named for Samuel Pierpont Langley, an early aviation scientist (see **Langley, Samuel Pierpont**).

Wayne Thompson

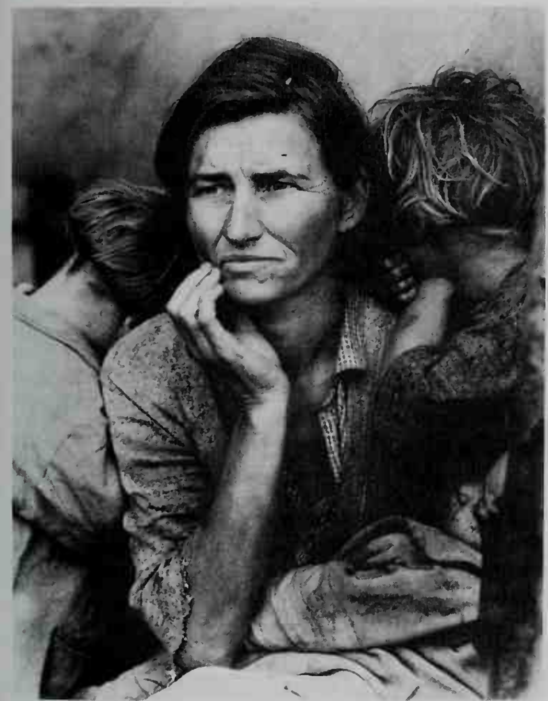
Langton, Stephen Cardinal (1165?-1228), one of England's greatest archbishops of Canterbury, was a famous theologian, Biblical scholar, and statesman. In the late 1100's, he became known as the greatest commentator on the Bible.

When King John wished to choose his own candidate as archbishop of Canterbury, Pope Innocent III objected and appointed Langton in 1207. The king refused to accept him, and Langton had to remain in exile in France. The pope placed England under an interdict and excommunicated the king in order to force him to accept Langton. John finally accepted Langton in 1213. As archbishop, Langton defended the freedom of the church and promoted peace between John and his barons. Also, he helped bring about Magna Carta (see **Magna Carta**).

William J. Courtenay

Langtry, *LANG tree,* **Lillie** (1853-1929), was an English actress. She became one of the first high society women of her day to go on the stage.

Langtry was born Emilie Charlotte Le Breton on the island of Jersey. Her father was the dean of Jersey, a high official in the Church of England. Langtry also was an intimate friend of the Prince of Wales, who later became King Edward VII. Because of her high social position, Langtry caused a sensation when she performed in 1881 as Kate Hardcastle in Oliver Goldsmith's *She Stoops to Conquer.* She became known as "The Jersey Lily" as a result of her birthplace and her outstanding beauty. Langtry gained wide attention when she later toured the British Isles, South Africa, and the United States as an actress. From 1901 to 1903, she managed the Imperial Theatre in London. Her autobiography, *The Days I Knew,* was published in 1925. J. P. Wearing



Library of Congress

A photograph by Dorothea Lange taken in 1936 captures the despair of a migrant family during the Great Depression.

Language is human speech, either spoken or written. Language is the most common system of communication. It allows people to talk to each other and to write their thoughts and ideas. The word *language* may be loosely used to mean any system of communication, such as traffic lights or Indian smoke signals. But the origin of the word shows its basic use. It comes from the Latin word *lingua,* meaning *tongue.* And a language still is often called a *tongue.*

Wherever there is human society, there is language. Most forms of human activity depend on the cooperation of two or more people. A common language enables human beings to work together in an infinite variety of ways. Language has made possible the development of advanced, technological civilization. Without language for communication, there would be little or no science, religion, commerce, government, art, literature, and philosophy.

According to *linguists* (scholars who study language), there are about 6,000 languages spoken in the world today. This number does not include *dialects* (local forms of a language). Many languages are spoken only by small groups of a few hundred or a few thousand people. There are more than 200 languages with a million or more speakers. Of these languages, 23 have about 50 million or more speakers each: Arabic, Bengali, Cantonese, English, French, German, Hindi, Italian, Japanese, Javanese, Korean, Malay-Indonesian, Mandarin, Marathi, Portuguese, Punjabi, Russian, Spanish, Tamil, Telugu, Turkish, Vietnamese, and Wu.

Young children quickly acquire command of a language when they have regular contact with fluent speakers of that language. Children listen to older people, imitate them, and gradually master a group of sounds used in the language. They also learn to associate particular words, such as "dog," "black," or "bark," with objects, ideas, and actions. At the same time, youngsters learn to make up sentences that other speakers accept as correct.

By the age of 5 or 6, children usually have a command of the basic sound and grammatical patterns of their native language. They are then able to communicate well enough for most of their own practical purposes. In school, they learn how to express themselves more precisely both in speaking and writing about more complex matters.

Learning a foreign language

There are many important reasons for learning a foreign language. Among them are the following:

(1) Learning a foreign language increases your range of communication. For example, if you speak only English, you can communicate with over 400 million other persons. If you also learn Spanish, you could speak to any of the 371 million Spanish-speaking people in Latin America, Spain, and other parts of the world.

(2) A foreign language can help add to your knowledge of your own language. For example, by studying Latin, you can improve your understanding of many of the thousands of English words that have Latin roots.

(3) Learning a foreign language helps you add to your general stock of information. A foreign language can be a key that unlocks new fields of knowledge. If you learn German you will be able to read books that are written in German on almost any subject you may wish to study.

Learning any language involves four different skills: (1) speaking, (2) understanding, (3) reading, and (4) writing. If you understand a foreign language, and can make yourself understood in speech and writing, you have mastered it.

Methods of study. No language is easy or difficult in itself. The ease or difficulty of any language depends on the age of the person learning it. Before the age of 10, all languages are equally easy when learned by the *natural speaking* method (listening and imitating). After 10, learning a language becomes more difficult. Therefore, it is desirable to learn foreign languages as early as possible. Some schools start foreign language instruction in kindergarten or in the primary grades.

After the age of 10, students can learn foreign languages by either, or both, of two methods: (1) the grammar method, and (2) the spoken language method.

In the *grammar* method, students learn general rules of grammar and apply them to specific situations. A French grammar lesson may stress the correct use of *gender* (masculine or feminine). Students learn that *le livre* (the book) is masculine and *la chaise* (the chair) is feminine. In this way, they learn grammar while they increase their vocabularies.

In the *spoken language* method, students try to duplicate the process by which young children learn language. They listen to the teacher, then imitate the sounds, words, and sentences.

Both the grammar method and the natural speaking method are effective. The ideal method for older children and adults seems to be a combination of the two.

Study aids. For hundreds of years, language students have used grammar books, exercise books, and dictionaries. Modern study aids—especially for spoken language—include (1) voice recordings with accompanying booklets; (2) tape recorders, which permit students to listen, repeat, erase their own repetition, then try again; (3) videotapes and closed-circuit TV's, which let students watch their mouth movements and compare them with those of a speaker; and (4) computers, which correct student translations of words and phrases on a video display screen. These language study aids provide not only instruction and practice, but also self-instruction, because they can be used without a teacher.

The makeup of language

All languages have certain things in common. These include (1) a sound-pattern, (2) words, and (3) grammatical structure.

A sound-pattern is a group of sounds that the human speech organs can utter. Most languages have from 20 to 60 of these sounds.

Words are sounds or sound-patterns that have a meaning. Words may stand for objects, actions, or ideas.

Grammatical structure is the manner in which certain elements of language are related to others in forming larger, meaningful units such as sentences. All languages have grammatical structures. Linguists commonly identify two aspects of grammatical structure, called *syntax* and *morphology.*

Syntax involves relations among elements of a sentence, including the arrangement of words in a par-



WORLD BOOK photo by Steinkamp/Ballogg

A language laboratory provides self-instruction in speaking and understanding a foreign language. The lab has tape recorders, headphones, and special desks. The recorders allow students to record their own voices. They use the headphones to listen to their pronunciation or to the pronunciation of the teacher. The walls help keep out distractions.

ticular order. In the English sentences *I see Mary* and *John sees Mark, I* and *John* are doers of the action. Thus, they are subjects of their sentences. *Mary* and *Mark* are receivers of the action—the ones who are seen—and are the direct objects of the sentences. These sentences illustrate a common word order in English of subject, verb, and object. The word order in the sentence *I Mary see* is not acceptable in English.

Morphology deals with elements that serve as building blocks for words. It uses a variation in the form of a word to show the function of the word in a group. The verbs in the previous paragraph differ in that *sees* has a morphological element that *see* lacks: the *-s* that signals a third-person verb form in English. In the sentence *The teacher asked a question,* the verb *asked* contains the *-ed* that signals past tense. The word *teacher* is made up of the verb *teach* and the element *-er* that signifies agent—that is, a teacher is one who teaches.

The roles of syntax and morphology vary from language to language. All languages have word order of some sort. In some languages, however, the word order is less strict than in others. Latin, for example, allows more variations in word order than English. The Latin sentences *Johannes videt Marcum* and *Marcum videt Johannes* both mean *John sees Mark.* Morphological elements indicate the relationship. *Johannes (John)* is the doer of the action, no matter where the word occurs, because it ends in *-s* (not *-m*). Similarly, *Marcum (Mark)* is the receiver because it ends in *-m* (not *-s*).

Some languages, such as Chinese, use syntax only. In other languages, such as Latin, the word order has little importance because word endings tell the story. Old English, or Anglo-Saxon (the form of English spoken until about A.D. 1100), resembled Latin in this way.

Modern English uses a blend of syntax and morphology. When we say *I see him,* we give two indications that *I* is the doer and *him* is the receiver. One indication is the position of *I* before *see* and *him* after *see.* The other is the fact that we use *I* (not *me*) for the doer, and *him* (not *he*) for the receiver.

Development of language

The makeup of a language does not remain the same over long periods of time. Grammar, vocabulary, and sound-patterns all change with usage.

How language began. No one knows how language began. Because all people who are not disabled have the ability to speak, language has probably existed at least as long as the modern human species. Most scholars believe that language developed very slowly from

Linguistic terms

*__Accent__ is the emphasis placed on a certain syllable of a word. We accent the syllable *lan* in the word *language.*

Agreement occurs when one part of speech changes its form to conform with another part. For example, the word *come* changes to *comes* when used with a third person singular subject, as in *he comes.*

Blend is a word made up of parts of two or more other words. *Brunch* (breakfast and lunch) is a blend.

Cognates are words in different languages that have the same original source. The English word water and the German word *Wasser* are cognates.

Coinage is an invented word. Manufacturers coined the words *kodak* and *zipper* to advertise their products.

Colloquialism is an informal, but not slang, expression such as *I've got it.* Colloquialisms are out of place in formal speech, but are widely used in daily speech.

*__Diacritical mark__ is a written sign used to show changes in sounds and pronunciation. The Spanish *tilde* (˜) gives an *n* an *ny* sound.

*__Etymology__ is a branch of linguistics that studies the origin and development of words.

Hybrid word is composed of parts from two or more languages. In the word *automobile, auto* comes from Greek and *mobile* from Latin.

Idiom is an expression in one language that cannot be accurately translated into another. The meaning of an idiom cannot be seen from the individual words in it. For example, *Look out!* means *Be careful!*

Jargon is a vocabulary and set of expressions used by a particular group of persons. Doctors, for example, use many words and expressions not used by the general public.

*__Linguistics__ is the scientific study of language in the broadest sense.

*__Literacy__ is the ability to read and write.

Loan word, such as *spaghetti,* is borrowed from another language, either in its original form or modified.

Neologism is a newly coined word that has not been generally accepted. *Grismal,* a combination of *grim* and *dismal,* is a neologism. The term also refers to the use of a word in a new meaning. For example, *contact* was once only a noun. Today, it is also a verb, as in *We will contact you,* and an adjective, as in *Football is a contact sport.*

*__Semantics__ is the study of the meaning of words.

*__Slang__ consists of words and phrases that are used in unconventional ways. An example is the word *grub* (food). The slang expression *klutz* means a *clumsy* person.

Vernacular is the spoken language of any area.

*Has a separate article in *World Book.*

sounds, such as grunts, barks, and hoots, made by prehuman creatures. According to this view, a simple system of vocal communication became more complex as the human brain and speech organs evolved. But no one knows when or how this process took place. In fact, there is no record of language for most of its existence. The first real evidence of language is writing. But scholars believe that writing did not appear until thousands of years after the origin of language. The earliest known written records are Sumerian word-pictures made about 3500 B.C. and Egyptian hieroglyphics that date from about 3000 B.C. (see **Hieroglyphics**). Written Chinese dates from perhaps 1500 B.C., Greek from about 1400 B.C., and Latin from about 500 B.C.

How language changes. No one knows all the reasons why languages change, but they continue to do so as long as people speak them. In a few cases, the changes can be explained. For example, words are added to a vocabulary to refer to new ideas or objects. Contacts between speakers of different languages may cause words from one language to enter another language.

Most language changes occur for unknown reasons. Languages do not become better or worse, only different. The change is very slow. Speakers of English may notice differences between how they and other English speakers talk and may also recognize certain changes in their own speech. But these differences do not make English speakers think that they are changing from one language to another. If present-day speakers of English try to read Old English, however, they find that it is as unlike modern English as is French or German. In modern industrial societies, language changes take place even more slowly. Educational systems and such centralized communication systems as radio and television promote the use of a standard form of a language. Under these conditions, a language is likely to remain more stable. However, language will probably never stop changing entirely.

Only when a language loses all its speakers does it stop changing completely. A language that is no longer spoken is called a *dead language.* Such languages include Sumerian, ancient Egyptian, Akkadian, Hittite, Etruscan, and Gothic.

Language families

Scholars classify languages into families. Language families are groups of languages that are related because they all developed slowly from a single earlier language called a *parent language.* When speakers of a language become divided into groups that are out of contact with each other, the language of each group continues to change in its own way. After several centuries, the individual groups speak so differently that they cannot understand each other. But the languages in each family are still related because all of them came from the same parent language.

Indo-European is the most widespread language family. Some 2,600,000,000 people, or about half the world's population, speak languages in this family. Most of the nations that gave rise to Western civilization speak Indo-European languages. Speakers of these languages originally lived in an area extending from northern India to western Europe. They now live in other parts of the world as well. Indo-European languages have become the most important tongues in most European countries, in Australia and New Zealand, and in the countries of North, Central, and South America.



Major language families and languages

The colors on the map represent the chief language families. The names identify the main languages in the families. The chart on the opposite page shows the approximate percentage of the world's people that speaks the languages in the chief families. Black African includes three major families.

The Indo-European family has 10 living branches. They are: (1) *Albanian,* (2) *Armenian,* (3) *Baltic,* (4) *Slavic,* (5) *Celtic,* (6) *Germanic,* (7) *Greek,* (8) *Indo-Aryan,* (9) *Iranian,* and (10) *Romance.* All these branches except Albanian, Armenian, and Greek include two or more separate languages. For a breakdown of these branches, see the table of the Indo-European language family in this article.

All languages in the Indo-European family have the same original structure, based on *inflections.* They all have clearly defined parts of speech. These include nouns, adjectives, pronouns, and verbs, which take certain endings to show gender, number, case, person, tense, mood, or voice. A large number of simple, basic words are similar in Indo-European languages. For example, the English word *mother* is *mātá* in Sanskrit, *mḗtēr* in Greek, *mater* in Latin, *madre* in Spanish, *Mutter* in German, and *mat'* in Russian.

Speakers of the parent Indo-European language probably lived in the area north of the Black Sea. From there, they likely migrated in several directions, changing the language along the way. The earliest Indo-

Indo-European
Sino-Tibetan
Afro-Asian
Uralic and Altaic
Japanese and Korean
Dravidian
Malayo-Polynesian
Mon-Khmer
Black African
Niger-Kordofanian
Nilo-Saharan
Khoisan
All others

WORLD BOOK map

European language of which we have a record is Hittite, followed by Greek and Sanskrit.

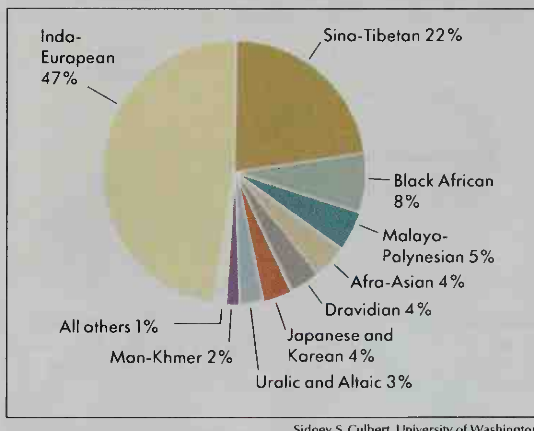
Other language families. Besides Indo-European, scholars have discovered numerous other language families.

The Sino-Tibetan family is second in numerical importance, with about 1 $\frac{1}{5}$ billion speakers. It includes Chinese with its many dialects, Thai, Burmese, and Tibetan. These languages are the leading languages of East Asia. Sino-Tibetan consists of one-syllable words. Speakers of languages in this family show the different meanings of otherwise identical words by changing their tone of voice.

The Afro-Asian family includes Arabic and Hebrew, the Berber tongues of North Africa, and the Amharic of Ethiopia. More than 220 million people speak languages in this family, which is concentrated in North Africa, the Near East, and northeast Africa.

The Uralic and Altaic family includes Finnish, Estonian, Hungarian (or Magyar), Turkish, and many languages in central and northern Asia. About 165 million people speak the languages in this family, which is found in Finland, Estonia, Hungary, Turkey, Turkenistan, Uzbekistan, Kazakhstan, Mongolia, and Siberia.

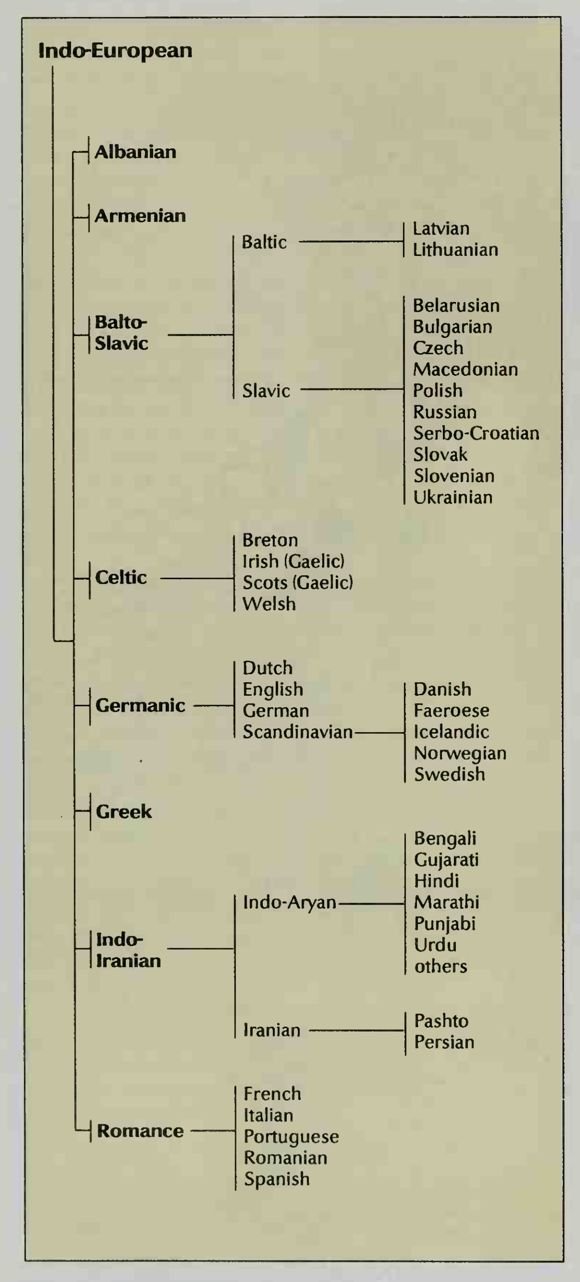
Japanese and Korean form a language family that has approximately 200 million speakers. They are largely limited to Japan, North Korea, and South Korea.



Sidney S. Culbert, University of Washington

The Dravidian family is located in southern India and parts of Sri Lanka. It consists of Tamil, Telugu, and other languages. These languages have more than 220 million speakers. See Dravidians.

The Malayo-Polynesian family includes the languages of Indonesia, the Philippines, Hawaii, New Zealand, Madagascar, and most other islands of the Pacific



Indo-European is the most widespread language family today. About half the people in the world speak a language in this family. Scholars divide the Indo-European languages into several groups, such as Balto-Slavic, Germanic, and Romance.

and Indian oceans. This language family has about 275 million speakers.

The Mon-Khmer family has about 110 million speakers in Southeast Asia and parts of India. This family is sometimes called Austro-Asiatic.

Black African languages are spoken in areas south of the Sahara and west of the Sudan, Ethiopia, and Somalia. The three main families of these African languages are Nilo-Saharan, Niger-Kordofanian, and Khoisan. These three groups have about 440 million speakers.

American Indian languages number over 1,000. But they are difficult to classify because of the great differences among them. Their total number of speakers does not exceed 20 million. These languages appear in isolated areas of North, Central, and South America.

Unusual languages and dialects include the pidgin and Creole tongues spoken in many parts of the world. They make communication possible between two or more groups that speak different languages. Examples include the colorful Melanesian pidgin English of the Solomon Islands and New Guinea; and Haitian Creole, based on French. See **Pidgin English**.

Universal languages

People have long been interested in having one language that could be spoken throughout the world. Such a language would help promote understanding and better feeling among nations. A universal language also would increase cultural and economic ties among various countries.

Through the years, at least 600 universal languages have been proposed. *Esperanto* is the most successful universal tongue. More than 10 million people have learned Esperanto since its creation in 1887. There are about 2 million speakers of Esperanto.

Some people suggest that an existing language, such as English, French, or Russian, be adopted as a universal language. The adoption of any language, artificial or natural, would greatly simplify communication. The real problem, however, lies in the choice of such a language because there are so many possibilities.

Many people oppose artificial languages. They believe that an artificial tongue does not reflect a true culture as existing languages do. Others oppose the use of any existing language as a world language. They claim that the culture of one or a few nations would be forced on all nations. As long as these arguments continue, the possibility of adoption of one world language appears dim. See **Universal language**.

The science of language

Between 400 and 200 B.C., the Indian grammarian Panini produced the first language study to meet rigorous linguistic criteria. He compiled a grammar of Sanskrit that linguists still admire as a model of precise and sophisticated description. During the Middle Ages, many people thought all languages came from Biblical Hebrew.

In the late 1700's, scholars such as Friedrich Schlegel, Jakob Grimm, and Franz Bopp, all of Germany, studied languages by the *comparative* method. They compared the world's languages and noted relationships among them. Their findings led to a classification of languages into families. During the early 1900's, Ferdinand de Saussure, a Swiss scholar, led a new movement. He studied languages by the *general* method. He established laws that apply to all languages.

Today, the science of language, called *linguistics,* is divided into two areas: (1) historical and comparative and (2) descriptive. The historical method studies language through thousands of years. It seeks to determine the history and development of individual languages and language groups. Comparative linguistics compares

related languages to reconstruct a hypothetical *proto-language* from which the related languages developed. The descriptive method concentrates mainly on present-day languages. See **Linguistics**. George Cardona

Related articles. Many *World Book* articles on countries have sections on language. For example, see **Canada** (Languages). Other related articles include:

Languages of the world

Arabic language
Aramaic language
Bemba
Chinese language
English language
French language
Gaelic language
German language
Greek language
Hebrew language
Italian language
Japanese language
Latin language
Portuguese language
Russian language
Sanskrit language
Semitic languages
Spanish language
Yiddish language

Spoken language

Dialect
Oratory
Phonetics
Pronunciation
Speech
Vocabulary
Voice

Written language

Composition
Cuneiform
Hieroglyphics
Punctuation
Rune
Writing

Other related articles

Accent
Alphabet
Anthropology (Linguistic anthropology)
Body language
Brain (In the use of language)
Celts
Communication
Consonant
Dictionary
Esperanto
Etymology
Figure of speech
Grammar
Indian, American (Language)
Interlingua
Inuit
Language arts
Linguistics
Literacy
Literature
Pacific Islands (Languages)
Pidgin English
Prehistoric people (The development of speech)
Reading
Semantics
Sentence
Sign language
Slang
Spelling
Teutons
Universal language
Vowel

Outline

I. Learning a foreign language
A. Methods of study
B. Study aids
II. The makeup of language
III. The development of language
A. How language began
B. How language changes
IV. Language families
A. Indo-European
B. Other language families
C. Unusual languages
V. Universal languages
VI. The science of language

Questions

How can learning a foreign language help you?
What three things do all languages have in common?
What is the chief language family?
What are the earliest written records of language?
What is the difference between *syntax* and *morphology*?
Why do some people oppose a universal language?
What is a *parent language*?
When does a language become a *dead language*?
How many languages are spoken in the world?
What are some reasons why languages change?

Additional resources

Aitchison, Jean. *The Seeds of Speech: Language Origin and Evolution.* Cambridge, 1996.
Comrie, Bernard, and others, eds. *The Atlas of Languages.* Facts on File, 1996.
Dalby, Andrew. *Dictionary of Languages.* Columbia Univ. Pr., 1998.
Wade, Nicholas, ed. *The Science Times Book of Language and Linguistics.* Lyons Pr., 2000.

Language arts is a term used in American elementary and secondary education to refer to training in reading, writing, and speaking, as distinguished from training in literary appreciation and scholarship. The term is also used in many colleges. Language arts, also referred to as "programs in communication," freely utilizes all types of knowledge, especially the social sciences and psychology, in the study of language and literature.

Beyond the elementary stages of reading, writing, and speaking, language arts includes a variety of topics: phonetics (for the improvement of pronunciation), remedial reading, linguistics, semantics (for the improvement of comprehension), creative writing, and bibliotherapy (the study of the kinds of reading that promote emotional growth and health). Language arts also includes the following studies: literature as a source of psychological and social insights, rather than exclusively as an art; the effects of mass communication; and the relations between language and culture.

The difference between the traditional approach to literature and the language arts approach may be roughly described as that between the consumer viewpoint and the producer viewpoint. The consumer viewpoint is learning to enjoy literature, while that of the producer is learning to use language skills and understand their operation. Robert J. Kispert

See also **Language** and its list of *Related articles.*

Langur, *lahng GUR,* is any of about 15 species of monkeys that live throughout India and most of Southeast Asia. Langurs are called "leaf-monkeys" because they eat chiefly leaves. The large stomach and intestines of these



WORLD BOOK illustration by John F. Eggert

The langur is a leaf-eating monkey that lives in India and Southeast Asia. The Hanuman langur, *shown here,* has a long tail and black face and hands. Hindus regard it as a sacred animal.

monkeys give them a potbellied appearance. Otherwise, langurs have a slender body, with a long tail. Their coat may be red, brown, silver, gray, golden, or black.

Adult langurs weigh from 11 to 40 pounds (5 to 18 kilograms). They measure 17 to 31 inches (43 to 79 centimeters) long, not including a 21- to 42-inch (53- to 107-centimeter) tail. Males are larger than females.

Langurs live in habitats ranging from warm, humid swamp forests to cold mountain areas. Almost all species live mainly in trees. A few species may spend much of their time on the ground.

Langurs live in groups that typically consist of from 10 to 40 members. Adult female langurs mate about once every two years. A pregnant female carries her young inside her body from 150 to 220 days, depending on the species. She almost always gives birth to one baby, but twins occasionally are born. Langur babies are often brightly colored. Other members of the group may help the mother care for her young.

The clearing of land for farming and lumber production threatens the survival of some langur species. One such species, the Hanuman langur, is regarded as a sacred animal by Hindus. For this reason, langurs have long been protected in India. Randall L. Susman

Scientific classification. Langurs belong to the Old World monkey family, Cercopithecidae. The scientific name for the Hanuman langur is *Presbytis entellus.*

See also **Monkey** (picture: Douc langur).

Lanier, *luh NEER,* **Sidney** (1842-1881), was an American poet. He became famous for his poems about the beauty of the South. Lanier's works also include children's poems and books on English literature.

Lanier's best-known poem, "The Marshes of Glynn" (1878), describes a wild, swampy, heavily wooded area near the coast of Georgia. His other major poems include "Corn" (1875) and "The Symphony" (1875). In "Corn," Lanier contrasted the abundance of Southern agriculture with what he considered the false, sterile values of Northern commerce. In "The Symphony," he experimented with the use of musical concepts, such as tone and rhythm. Throughout this poem, Lanier attempted to imitate the sounds of the various instruments of an orchestra. "The Symphony" became popular in the 1800's, but later critics do not rank it among his best works.

Lanier was born in Macon, Georgia, and graduated from Oglethorpe College in 1860. He served in the Confederate Army during the Civil War (1861-1865) and spent four months in a prison camp. Lanier returned to Macon after the war, penniless and in poor health. He suffered from tuberculosis for the rest of his life. In 1867, he published his only novel, *Tiger-Lilies,* an account of his war experiences. Later, Lanier studied law and then entered his father's law firm because he could not earn enough money as a writer.

In 1873, Lanier resumed his writing career. He moved to Baltimore, where he soon gained a reputation as a poet. In 1879, he became a lecturer in English literature at Johns Hopkins University. At Johns Hopkins, Lanier wrote such works as *The Science of English Verse* (1880) and *The English Novel* (1883). In his book about English poetry, Lanier declared that a poem's musical rhythm or sound is its most important and exciting quality.

During his last years, Lanier edited children's books. He wrote "The Revenge of Hamish" (1878), which became one of his most popular poems for children. Lanier also retold the legends of King Arthur's court in *The Boy's King Arthur* (1880). Jerome Loving

Lankester, *LANG kih stuhr,* **Sir Edwin Ray** (1847-1929), a British zoologist, did extensive research in comparative anatomy and embryology. His work helped support the theory of evolution (see **Evolution**). Lankester served as director of the British Museum's natural history department from 1898 until 1907. From 1869 to 1920, he edited *The Quarterly Journal of Microscopical Science.* Lankester was born in London. G. J. Kenagy

Lanolin, *LAN uh lihn,* is a substance obtained from the greasy coating found on sheep's wool. A common name for lanolin is *wool fat,* though lanolin is classified chemically as a wax. Lanolin is a mixture of more than 200 organic compounds.

There are two forms of lanolin—anhydrous *and* hydrous. Anhydrous lanolin is a yellowish, sticky solid that melts at temperatures from 38 °C to 44 °C. Hydrous lanolin is an emulsion consisting of tiny drops of lanolin evenly distributed in water. See **Emulsion.**

Lanolin helps the skin retain water and is an *emollient* or moisturizer. Lanolin can make dry skin feel soft and smooth, so it is used in hand creams and cosmetics. Lanolin also can retain various medicines, so it is often used as a base for ointments and salves. Robert C. Gadwood

Lansdowne, *LANZ down,* **Marquess of,** *MAHR kwihs* (1845-1927), was a British colonial administrator who served as governor general of Canada from 1883 to 1888. As governor general, Lansdowne supported construction of the coast-to-coast Canadian Pacific Railway. The railway was completed in 1885.

Lansdowne was born in London. His given and family name was Henry Charles Keith Petty-Fitzmaurice. Upon the death of his father in 1866, he became the Fifth Marquess of Lansdowne and inherited one of the largest estates in England. From 1888 to 1893, Lansdowne served as *viceroy* (ruler) of India, then a British colony. He was British foreign secretary from 1900 to 1905. During this period, he helped the United Kingdom work out a military treaty with Japan and an agreement of friendship with France called the *Entente Cordiale.* Jacques Monet

Lansing (pop. 119,128) is the capital of Michigan and an automobile-manufacturing city. Lansing lies at the meeting place of the Grand and Red Cedar rivers in south-central Michigan. It is about 85 miles (137 kilometers) northwest of Detroit. Lansing covers an area of about 34 square miles (88 square kilometers). For the location of Lansing, see **Michigan** (political map).

Lansing is the largest city in the Lansing-East Lansing metropolitan area, which includes Clinton, Eaton, and Ingham counties. The metropolitan area has a population of 447,728.

Hundreds of industries operate in the metropolitan area. The chief products include automobiles, automobile bodies and parts, and gasoline engines. Lansing is a trading center for the surrounding rich farmlands. Freight railroads, buses, and trucks serve the city. Airlines use Capital City Airport. Lansing has one daily newspaper, *The Lansing State Journal.*

The Michigan School for the Blind is in the city. East Lansing is the home of Michigan State University, which was the first state school to offer agricultural courses for credit.

The Michigan Library and Historical Center is located near the domed State Capitol Building. Workers completed the white sandstone capitol in 1878.

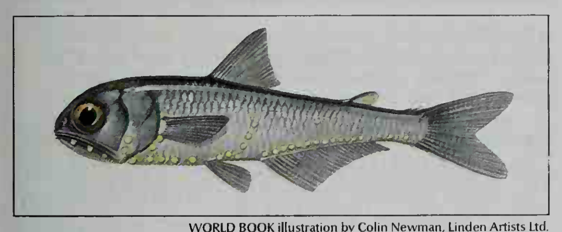
Settlers first came to the site of Lansing in 1837. The legislature chose Lansing to succeed Detroit as the state capital in 1847. Lansing received its city charter 12 years later, in 1859. Lansing has a mayor-council form of government. Peter Gavrilovich

Lansing, Robert (1864-1928), served as United States secretary of state under President Woodrow Wilson from 1915 to 1920. He dealt with difficult problems resulting from World War I and attended the Peace Conference held at Versailles, France, as one of the five U.S. delegates in 1919 (see **Versailles, Treaty** of).

Lansing was a specialist in international law before becoming secretary of state. He was a lawyer for the U.S. government in disputes over the Alaskan boundary and the North Atlantic fisheries. He wrote several books on international law and on the Versailles peace negotiations. Lansing was born in Watertown, New York, and studied at Amherst College. He began his legal practice in 1889 in Watertown. Kendrick A. Clements

Lanternfish is the name of a large group of small fish with pearllike organs that give off light. The ability of certain living things to produce light is called *bioluminescence* (see **Bioluminescence**). More than 1,000 species of fish are bioluminescent. Most of them, including lanternfish, live in the deep waters of the open sea.

There are over 230 species of lanternfish. Most adult lanternfish are less than 6 inches (15 centimeters) long.



WORLD BOOK illustration by Colin Newman, Linden Artists Ltd.

The lanternfish has organs along the sides of its head and body that enable the fish to create its own light.

The fish's light-producing organs, called *photophores,* develop chiefly on the lower part of the body. Each species has a different arrangement of photophores. Lanternfish use their bioluminescence to communicate with one another and to attract prey. Their light also acts as a camouflage to protect them from enemies. The fish are invisible from below because their glowing undersides match the light of the sunlit or moonlit sea surface. In addition, the dark, unlighted backs of many lanternfish match the darkness of the deep water, making them invisible to enemies above.

Lanternfish often form schools of hundreds of thousands of fish. They swim at greater depths during the day and migrate to shallower depths at night.

Leighton R. Taylor, Jr.

Scientific classification. Lanternfish belong to the lanternfish family, Myctophidae.

Lanthanide. See **Rare earth; Element, Chemical** (Periodic table of the elements).

Lanthanum, *LAN thuh nuhm,* is a soft, silvery-white metallic element. It tarnishes rapidly when exposed to air. Lanthanum is found in rare earth mineral ores such as monazite and bastnasite. It also can be produced in nuclear reactors by the fissioning of uranium, thorium, or plutonium. The Swedish chemist Carl Mosander first identified lanthanum in 1839. Its name comes from a Greek word meaning *to be hidden* or *concealed.*

Lanthanum forms part of an alloy called *misch metal,* which is used in making flints for cigarette lighters. Lanthanum oxide is added to the glass used for camera lenses to increase its ability to *refract* (bend) light.

Lanthanum has an atomic number of 57 and an atomic weight of 138.9055. Its chemical symbol is La. Lanthanum melts at 921 °C and boils at 3457 °C. S. C. Cummings

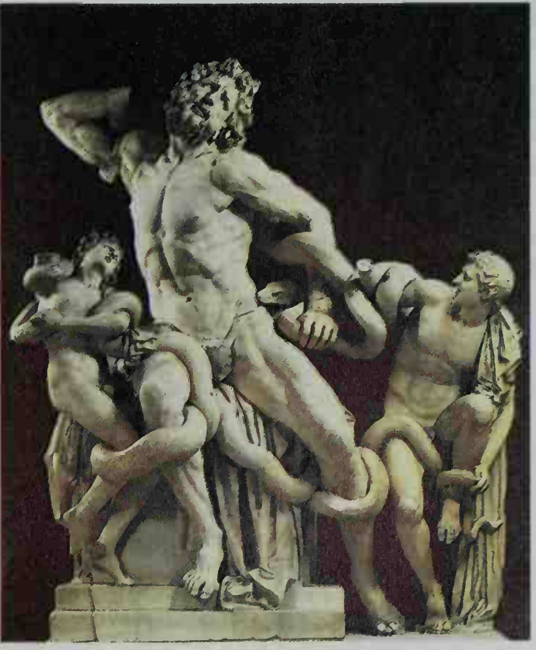
See also **Element, Chemical** (table); **Rare earth.**

Lanzhou, *lahn joh* (pop. 1,617,761), also spelled *Lanchou,* is the capital of Gansu Province in north-central China (see **China** [political map]). It was known as the *Gateway to China* in the Middle Ages. At that time, the city was an important stop on the Silk Road, a caravan route to the West. Marco Polo and other traders traveled the Silk Road, carrying Chinese goods to Europe and western Asia. A large proportion of China's relatively few Muslims live in Lanzhou. Many of them are descended from Arab traders and soldiers.

After the Communists took over China in 1949, Lanzhou became an important center for the industrial development of China's northwest. The city now has factories that produce chemicals, machinery, and petroleum and lubricants. Railroads link Lanzhou with cities to the north, east, and south. Frederic Wakeman, Jr.

Lao Tzu. See **Laozi.**

Laocoön, *lay AHK oh ahn,* a Trojan priest, warned his people against the Greeks at Troy. The Trojans and the



Restored marble statue (about A.D. 100), by Agesander, Polydorus, and Athenodorus of Greece; Vatican Museums, Rome (SCALA/Art Resource)

Laocoön was a Trojan priest in Greek mythology who warned his people against the Greeks during the Trojan War. Two sea serpents attacked him and his sons and crushed them to death.

Greeks had been at war for 10 years. Pretending to give up the siege, the Greeks left a huge wooden horse outside the gates of Troy. Laocoön suspected treachery. He told the Trojans not to take the horse inside the city. "I fear the Greeks, even when bringing gifts," he said.

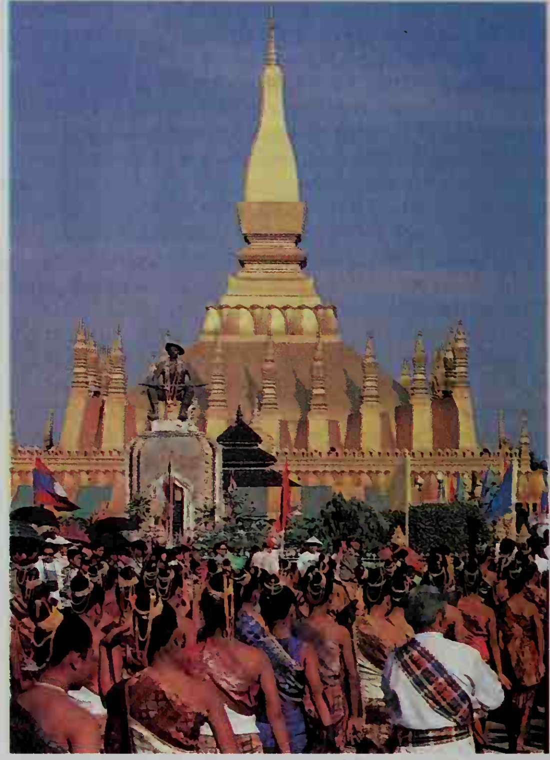
Later, as Laocoön worshiped, two sea serpents attacked him and his sons and crushed them to death. Believing this to be a punishment from the gods, the Trojans rejected Laocoön's warning and took the wooden horse into the city. Laocoön had been right. The horse concealed Greek soldiers who came out of the horse during the night and captured the city. Virgil describes the death of Laocoön in the second book of the *Aeneid.*

See also **Trojan War.** Cynthia W. Shelmerdine

Laos, *LAH ohs,* is a landlocked country in Southeast Asia. It is bordered by China to the north, Vietnam to the east, Cambodia to the south, and Thailand and Myanmar to the west. Much of Laos is mountainous, especially in the north and east. Most of the western border is formed by the Mekong River. The official name of Laos is the Lao People's Democratic Republic. Vientiane is the nation's capital and largest city.

Laos has many ethnic groups. The ethnic Lao make up a majority of the population, and the country is named after them. Most ethnic Lao live in the country's lowland plains and valleys.

Laos came under French authority in the late 1800's. It regained full independence in 1953. The Communist Pathet Lao movement has controlled the government since it seized power in 1975.



© Bill Wasserman, The Stock Market

A Buddhist festival, *shown here,* takes place every November in Vientiane, the capital of Laos, at a towering *stupa* called That Luang. A stupa is a monument that houses relics of Buddha.

Government

Laos is governed by a single party, the Lao People's Revolutionary Party (LPRP). The leaders of the party's Political Bureau and Central Committee are the most powerful officials in the country.

The National Assembly is Laos's legislative body. The people elect its 99 members to five-year terms. All Assembly candidates must be approved by the LPRP. The Assembly elects the president of Laos to a five-year term. The president serves as head of state. The president, with the approval of the Assembly, appoints a cabinet and a prime minister, who serves as head of the government. The Supreme People's Court is the highest court.

People

More than 50 ethnic groups live in Laos. They are officially divided into three broad categories: (1) the Lao Lum, (2) the Lao Thoeng, and (3) the Lao Sung.

The Lao Lum—that is, the *Lao of the lowlands*—include the ethnic Lao, as well as the Lu, Phuan, and various upland Tai tribes. The Lao Lum speak Tai languages, including Lao, which is the official language of Laos. Most Lao Lum live in villages of 40 to 50 households. Their houses are typically built above the ground on wooden posts. Most Lao Lum are Buddhists, and the *wat* (temple) is the social center of the village. They grow rice on irrigated paddies. Their main food is *glutinous* (sticky) rice eaten with chopped meat or fish and vegetables.

The Lao Thoeng—the *Lao of the mountain slopes*—speak Mon-Khmer languages. They grow rice by using *slash-and-burn cultivation* in which trees are chopped and burned to make way for farmland. Chief groups of the Lao Thoeng include the Khmu and Lamet in northern Laos and the Alak, Laven, and Oy in the south. Most Lao Thoeng are *animists* who worship a variety of nature spirits and carry out animal sacrifices.

The Lao Sung—the *Lao of the mountaintops*—live in northern Laos. They speak Tibeto-Burman or Hmong-Mien languages. Most follow animistic religions. The main ethnic groups of the Lao Sung include the Hmong and the Yao (also known as the Iu Mien). The Hmong

Facts in brief

Capital: Vientiane.
Official language: Lao.
Area: 91,429 mi² (236,800 km²). *Greatest distances*—northwest-southeast, 650 mi (1,046 km); northeast-southwest, 315 mi (510 km).
Population: *Estimated 2002 population*—5,709,000; density, 62 persons per mi² (24 per km²); distribution, 83 percent rural, 17 percent urban. *1985 census*—3,584,803.
Chief products: Benzoin, cardamom, cattle, cinchona, citrus fruits, coffee, corn, cotton, leather goods, opium, pottery, rice, silk, silver work, tea, teak, tin, tobacco.
Flag: The flag has a red horizontal stripe at the top and the bottom, and a blue horizontal stripe in the center. A white circle appears in the center of the flag. The red symbolizes the blood and the soul of the Laotian people. The blue stands for prosperity. The white circle represents the promise of a bright future. Adopted in 1975. See **Flag** (picture: Flags of Asia and the Pacific).
National anthem: "Pheng Sat" ("National Music").
Money: *Basic unit*—kip. One hundred at equal one kip.

raise most of Laos's opium poppies, from which illegal heroin is made.

The vast majority of the people of Laos live in rural areas. Most villagers are poor. But as the population expands, more Laotians are moving to towns along the Mekong River. There, they find employment and better education and health services for their children.

About two-thirds of the Laotian people 15 years of age or older can read and write. Most Laotians attend elementary school, which lasts five years. Some attend a further six years of secondary school. The National University of Laos in Vientiane is the country's only university.

Land and climate

Rugged mountains rise in northern Laos, and the Annam Range extends along the border with Vietnam to the east. Phou Bia (Mount Bia) is the country's highest peak. It rises 9,245 feet (2,818 meters) in central Laos. The Mekong is the country's largest river.

Laos has three high plateaus. They are the Plain of Jars in the north, the Khammouan Plateau in central Laos, and the Bolovens Plateau in the south. Forests on the plateaus have largely been cleared for agriculture, but trees still cover much of the mountains.

Rainfall in much of Laos averages approximately 70 inches (180 centimeters) a year, but rainfall on the Bolovens Plateau averages about twice that amount. The rainy season lasts from May to October. Temperatures can reach 104 °F (40 °C) at the end of the dry season in March and April but can fall below freezing in the mountains in winter.

Economy

Laos has little industrial development, and the country is the poorest in Southeast Asia. Following the Communist take-over in 1975, the government tightly controlled the economy. Since the late 1980's, however, the authorities have relaxed their hold on the economy and encouraged private enterprise and foreign investment.

A majority of Laotian workers are farmers. Most own small farms on which they grow rice. Some farmers also raise cattle, goats, hogs, horses, poultry, and water buffaloes. The main export crop is coffee.

Laos's forests provide rattan, teak, and other products. Small amounts of tin, gypsum, rock salt, and coal are mined in Laos. Most trade is with neighboring states, especially Thailand. Laos sells most of the hydroelectric power that it produces to Thailand.

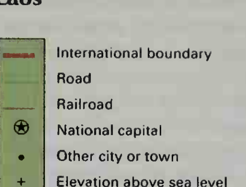
Laos has no railroads. It also has few roads, and most of them are unpaved. The main international airport is in Vientiane. The government controls newspapers, radio, and television.



© Josef Beck, FPG

Farmers in Laos live mainly in fertile river valleys. They grow rice—the chief food crop—in irrigated paddies like this one.

Laos







WORLD BOOK maps

History

A highly developed culture arose on the Plain of Jars about 500 B.C. The people of this culture carved huge stone jars in which to place the ashes of their dead.

Small groups of Tai people probably began to move into the northern part of Southeast Asia from about the A.D. 700's. Lao warriors may have established a small *principality* (territory ruled by a prince) near Louangphrabang as early as the 900's. Other Lao settlers pushed farther south. In the early 1200's, small kingdoms that had been established on the middle Mekong fell under the rule of the Khmer (Cambodian) empire.

In 1353, a Lao prince named Fa Ngum unified several Lao principalities into the kingdom of Lan Xang. In the early 1700's, a succession dispute divided Lan Xang into

three kingdoms. By the early 1800's, all three had come under the control of Siam (now Thailand). At the end of the 1800's, France incorporated nearly all of present-day Laos into its Indochina empire. It acquired control of the rest by 1907. A large part of the former kingdom of Lan Xang remained under Siamese control.

Laos was briefly occupied by Japan during World War II (1939-1945). After the Japanese surrendered in 1945, Lao nationalists who were part of the Free Laos movement seized power. However, the French regained control in 1946. Independence within the French Union, as the Kingdom of Laos, came in 1949. Laos gained complete independence in 1953. Meanwhile, the Free Laos movement had split up into several factions. In northeastern Laos, Souphanouvong, the leader of one of the factions, set up the Communist-inspired Pathet Lao movement.

The Geneva Accords of 1954 left the two northeastern provinces of Laos under Pathet Lao control. The rest of the country was ruled by the Royal Lao Government (RLG) with Souvanna Phouma as prime minister. In 1957, Souvanna Phouma and Souphanouvong formed a coalition government and reunited the country under RLG administration. The coalition collapsed, however, and in 1959, Laos plunged into civil war. A second coalition government was agreed upon in 1962. But that government also failed, and in 1963, government and Pathet Lao forces resumed fighting each other. By then, the Vietnam War had also begun.

The Vietnam War was fought between Communist-ruled North Vietnam and Communist-trained South Vietnamese rebels on one side and South Vietnam and the United States on the other side. Laos tried to remain neutral during the war but was increasingly drawn into the conflict during the early 1960's. From the mid-1960's until 1973, U.S. warplanes heavily bombed sections of Laos, particularly the Ho Chi Minh Trail in the eastern part of the country. North Vietnam used the Ho Chi Minh Trail for moving supplies and troops through Laos and into South Vietnam. Also during the war, the United States Central Intelligence Agency (CIA) recruited and trained a "secret army" in Laos to fight against the Communists. This army was drawn mainly from the Hmong. Following the North Vietnamese victory in Vietnam in April 1975, thousands of Hmong and other Laotians fled Laos.

In December 1975, the Pathet Lao finally gained power and abolished the monarchy. At first, the government seized ownership of farms and factories and persecuted Buddhists. But as peasants mounted opposition to the government's agricultural policy and people continued to visit Buddhist temples, the regime changed course. Beginning in the mid-1980's, the government introduced an economic policy that encouraged foreign investment and returned farms and some industries to private ownership. In 1997, Laos joined the Association of Southeast Asian Nations (ASEAN), a regional organization that promotes economic, cultural, and social cooperation among its members. Martin Stuart-Fox

Related articles in *World Book* include:

Association of Southeast Asian Nations
Colombo Plan
Geneva Accords
Hmong
Indochina
Mekong River
Southeast Asia
Vientiane
Vietnam War

Laozi, according to legends, wrote the *Laozi,* one of the basic books of the Chinese philosophy called *Taoism,* also spelled *Daoism.* This book is often called the *Tao Te Ching (The Classic of the Way and the Virtue).* Laozi's name is also spelled *Lao Tzu.*

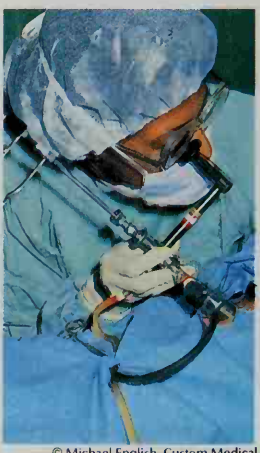
Unreliable accounts say that Laozi lived during the 500's B.C. However, the *Tao Te Ching,* made up of 81 brief sections, was probably compiled and revised during the 200's and 100's B.C. More than half its sections are in rhyme. The remainder of the book includes popular sayings and Taoist teachings in prose.

The *Tao Te Ching* describes the *Tao* (Way), the unity of nature that makes each thing in the universe what it is and determines its behavior. This unity can be understood only by mystical intuition. The book teaches that, because yielding eventually overcomes force, a wise man desires nothing. He never interferes with what happens naturally in the world or in himself. One passage says: "The highest good is like water. Water excels in giving benefit to all creatures, but never competes. It abides in places that most men despise, and so comes closest to the Tao." The *Tao Te Ching* also teaches that simplicity and moving with the flow of events are the keys to wise government. N. Sivin

See also **Taoism; Zhuangzi.**

Laparoscopy, *LAP uh RAHS kuh pee,* is a surgical technique used to examine organs and to detect and treat certain diseases within the abdomen. Doctors use an instrument called a *laparoscope* to perform this technique. The laparoscope is a metal tube with lenses, an illumination system, and a channel for surgical instruments. It is inserted into the abdomen through a small opening made in the abdominal wall. The doctor can observe the liver, gallbladder, spleen, and, in a woman, the reproductive organs. Laparoscopy allows doctors to detect cirrhosis or cancer of the liver, and disorders of other abdominal organs and the lining of the abdominal cavity.

Surgeons can treat certain diseases by passing special instruments through the laparoscope and moving them in the abdomen. For example, doctors can use this technique to remove the gallbladder (see **Gallbladder**). Surgeons also use the laparoscope to perform *laparoscopic sterilization,* an operation that prevents pregnancy in



© Michael English, Custom Medical



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A surgeon uses a laparoscope to operate on a patient's abdomen. The instrument is inserted into an opening in the abdomen. A bile duct in the liver can be seen in a photograph taken through the laparoscope.

women. This procedure cuts or destroys a portion of the woman's fallopian tubes or blocks the tubes.

Marshall Sparberg

La Paz, *lah PAHS* or *luh PAZ* (pop. 976,800), is the largest city and chief commercial center of Bolivia. It also serves as the country's actual capital, with offices of the executive and legislative branches of government located there. The Supreme Court is the only major Bolivian government institution located in Sucre, the official capital. The city lies on the slopes and bottom of a canyon in the *altiplano* (high plateau) region of western Bolivia. Snow-capped peaks of the Andes Mountains overlook the city. La Paz is the world's highest capital. At its center, it is 12,500 feet (3,810 meters) above sea level (see **Bolivia** [map]).

Aymara Indians make up about half the population of La Paz. Many of them live on the upper terraces of the canyon in adobe huts with corrugated iron or red tile roofs. Farther down both sides of the canyon are modern skyscrapers and government buildings. The center of city life is the Plaza Murillo, a square with impressive gardens. The Presidential Palace, the National Congress, and a cathedral face the plaza. Tall office buildings and several museums stand nearby. On the floor of the canyon is a modern residential section where people of European ancestry and *mestizos* (people of mixed white and Indian ancestry) live.

The city also has a large, busy market where people gather to buy food. Indians dressed in traditional styles sell beautifully handwoven shawls and blankets there. La Paz is the home of the Higher University of San Andrés and the Bolivian Catholic University.

La Paz has a high unemployment rate. The Bolivian government employs about half the people who have a job. Importing and exporting companies are the city's most important businesses. La Paz has few large factories. The chief manufactured products include beer, canned food, cement, glass, and textiles.

Spanish settlers led by Alonso de Mendoza founded La Paz in 1548 on the site of an Aymaran Indian village. The town grew steadily because it lay on the route used to transport silver from rich mines in southeastern Bolivia to the Pacific coast. In 1899, most of Bolivia's government agencies moved from Sucre to La Paz. Since then, La Paz has been both the governmental and commercial center of Bolivia. Nathan A. Haverstock

See also **Bolivia** (picture: La Paz); **Latin America** (picture: Middle-class housing).

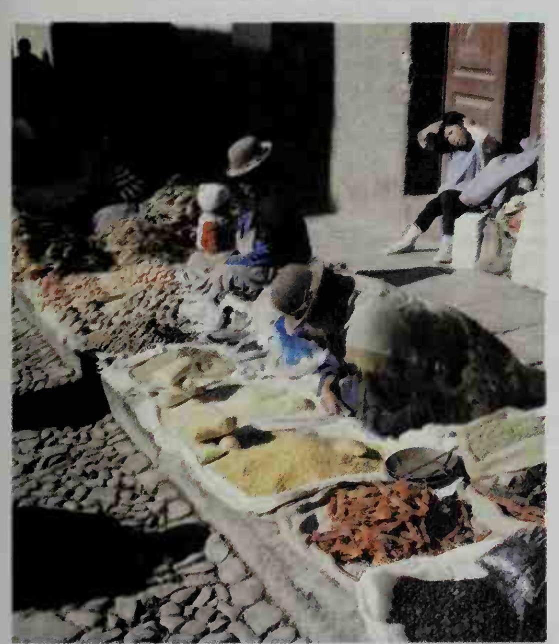
Lapidary is the cutting and polishing of colored stones. The person who does this work is called a *lapidary* or a *lapidist.* Professional lapidaries flourished in Assyria, Babylonia, and Egypt more than 6,000 years ago.

Colored stones may be cut in several ways. Different machines and techniques are used, depending on the type of stone being cut. For example, lapidaries cut some stones in a style called *cabochon,* with a rounded top and a flat bottom. Many gems, such as diamonds, are cut so they have numerous flat, polished *facets* (surfaces). Lapidary also includes the carving and engraving of gems.

Professional lapidaries have traditionally kept their methods secret. During the 1920's in the United States, several men who collected gems as a hobby decided to learn how to cut and polish their own stones. They built equipment and developed cutting and polishing techniques by trial and error. Amateur lapidary art soon became a popular hobby. Today, there are many amateur lapidary clubs, some of which have groups for teenagers. However, most diamond cutting is done by professionals because of the special machines and methods involved. John S. Lizzadro

See also **Diamond; Gem.**

Lapis lazuli, *LAP ihs LAZ yuh ly* or *LAP ihs LAZ yuh lee,* is a beautiful azure-blue stone used as an ornament.



© SuperStock

La Paz is Bolivia's largest city and chief commercial center. Aymara Indians make up about half the city's population. The city has a large, busy market where people gather to buy food.



© Francis G. Mayer, Corbis

Lapis lazuli is a deep blue semiprecious stone that has been used in making ornamental objects since ancient times. This lapis lazuli bowl with a gold handle was created about 1580.

It consists chiefly of *lazurite,* a mineral composed of sodium, aluminum, silicon, oxygen, and sulfur. Most lapis lazuli also contains such minerals as calcite, pyrite, and sodalite. Small amounts of yellow pyrite help to identify the stone as genuine lapis lazuli. But the presence of white calcite generally lowers the value of lapis lazuli. Large deposits of lapis lazuli are found in the Hindu Kush mountains of Afghanistan and at the southwestern end of Lake Baikal in Russia.

Lapis lazuli has been used in jewelry since ancient times. The tomb of King Tutankhamen, who ruled Egypt during the 1300's B.C., contained many objects made of gold and lapis lazuli. Ancient peoples believed that lapis lazuli had medicinal value. They ground the stones to a powder, which was mixed with milk. The mixture was used as a dressing for boils and ulcers. Lapis lazuli was once ground to produce *ultramarine,* a blue pigment used in paintings. Finley C. Bishop

See also **Gem** (picture).

Laplace, *la PLAS,* **Marquis de,** *mar KEE duh* (1749-1827), a French astronomer and mathematician, became famous for his theory regarding the origin of the solar system. In Laplace's *Exposition of the System of the Universe* (1796), he started with a theoretical primitive nebula. He believed that this huge, lens-shaped cloud of gas rotated, cooled, contracted, and threw off planets and satellites. The remaining matter formed the sun. Laplace's nebular hypothesis was accepted by scientists for a long time. But that hypothesis has now been replaced by other theories. However, scientists still have not solved the problem of the solar system's origin. See **Earth** (Formation of Earth).

Laplace also contributed studies in mathematical astronomy. Sir Isaac Newton had satisfactorily explained movements of the solar system in general. But certain problems were not solved because no one in Newton's time had devised the necessary mathematical tools. Laplace accounted for the intricacies in the movements of the heavenly bodies. In *Celestial Mechanics* (1799-1825), he summed up the achievements in theoretical astronomy from the time of Newton.

Pierre Simon Laplace was born on March 23, 1749, at Beaumont-en-Auge, France, the son of a farmer. He became a professor of mathematics in Paris at age 20. He was probably made a marquis in 1817. A. Mark Smith

Lapland is the northernmost region of Europe. It covers the far northern parts of Norway, Sweden, and Finland, and the Kola Peninsula of Russia. Lapland has no definite boundary to the south, but it ends approximately at the Arctic Circle. It covers about 150,000 square miles (388,000 square kilometers).

Lapland got its name from its native people, who used to be called Lapps. The Sami, as they are now known, have lived in Scandinavia for thousands of years. They call their territory Sapmi. Sapmi includes all of Lapland and extends south of the Arctic Circle through the mountains of Norway and Sweden to about 62 degrees north latitude.

Winter in Lapland lasts from October to May. During winter, lakes and rivers are frozen, and the land is covered with snow. Winter temperatures fall as low as 0 °F (-18 °C) at the coast and -60 °F (-51 °C) inland. In summer, temperatures rise as high as 70 °F (21 °C) at the coast and 80 °F (27 °C) inland. Because Lapland lies so far north, it has a period of two months in summer when the sky never darkens. On the other hand, the sun never rises above the horizon for two months in winter.



Location of Lapland

Most of Lapland is a bleak, barren region with stunted trees and thin vegetation. However, some areas have extensive forests of birch, pine, and spruce. The cold climate limits the growth of most trees. Other plant life includes shrubs and berry bushes. Mosses and lichens are an important food for the region's reindeer.

Iron ore and nickel are Lapland's most valuable mineral resources. Beds of iron ore lie beneath the soil of southern Swedish Lapland. The Russian part of the region has nickel deposits. Lapland's iron ore deposits rank among the world's largest. M. Donald Hancock

See also **Finland; Norway; Sami; Sweden.**

La Plata, Río de. See **Río de la Plata.**

Lapps. See **Lapland; Sami.**

Laptop computer is a lightweight, portable, battery-operated computer that is usually not much larger than a hardcover book. The unopened computer lies flat like a book laid sideways, with the spine away from the user. When the user opens the computer, the screen—the front cover of the "book"—swings up to a vertical position.

Some laptop computers weigh less than 4 pounds (2 kilograms). The smallest are also called *notebook computers.* Despite their size, laptop computers offer all the capabilities of desktop machines.

Small, built-in pointing devices enable laptop users to control the *cursor,* the electronic marker that indicates on the screen where the next operation will take place. Many laptops have a tiny control lever that is used to move the cursor. Others are fitted with a *touchpad* or a *trackball.* A touchpad is a rectangular pad located beneath the space bar on the keyboard. It measures small changes in electric fields as the user's finger glides over its surface. The cursor moves in the same direction as the user's finger. A trackball is a small ball built into the keyboard. The cursor moves in the same direction the user rolls the ball with his or her fingers.

Laptop computers are especially popular among businesspeople who travel. Many such computers can run for several hours before their battery must be recharged. A laptop computer can also be operated from

an electric outlet using a plug-in adapter. Some laptop machines have keyboards that extend to full size when the computer is opened, making typing easier.

Keith Ferrell

Lapwing is a crested bird that lives in western Europe. The lapwing's name comes from the awkward way it flaps its wings as it flies. The bird is also called a *peewit*



WORLD BOOK illustration by Trevor Boyer, Linden Artists Ltd.

The lapwing has a crest that ends in a pointed peak. The bird lives in western Europe. It lures enemies away from its nest by pretending to be injured.

because of its shrill, wailing cry. The lapwing has a bronze-green back and a blue-black throat and breast. Its crest is long and pointed. When the lapwing's nest is threatened, it limps and pretends to be hurt and lures its enemies away. George L. Hunt, Jr.

Scientific classification. The lapwing belongs to the family Charadriidae. It is *Vanellus vanellus.*

Lar. See **Lares and penates.**

Laramie, *LAR uh mee* (pop. 27,204), is the third largest city in Wyoming. Only Casper and Cheyenne have more people. Laramie lies on the Laramie Plains in the south eastern part of the state. The Laramie River flows past the city. For Laramie's location, see **Wyoming** (political map).

Laramie is the center of a large cattle- and sheep-raising region. The University of Wyoming, located in Laramie, is the largest employer in the city. The city's industrial products include cement, and lumber and other forest products. A regional airport is located near Laramie. Tourists enjoy sightseeing and such activities as skiing, snowmobiling, and trout fishing in the Medicine Bow Mountains 30 miles (48 kilometers) west of the city.

Laramie was founded in 1868, when Union Pacific tracks reached the city. It was named for Jacques Laramie, a fur trapper who explored southeastern Wyoming (see **Laramie, Jacques**).

Laramie is the county seat of Albany County. It has a council-manager government. Ronald E. Beiswenger

Laramie, *LAR uh mee,* **Jacques,** *zhahk* (? -1821?), was an American fur trapper who explored southeastern Wyoming. He became the first white man to visit certain sections of that area.

While trapping in the Colorado region about 1818, Laramie entered southeastern Wyoming. In 1820, he built a cabin on the river which he explored and which was named for him. Although little is known of him, many geographical features and places in Wyoming bear his name. Among these are the Laramie Mountains, Laramie Park, Laramie County, and the city of Laramie. Laramie was possibly born in Canada of French descent, or he may have been a member of the *métis* (people of mixed white and Indian ancestry) who lived around the Great Lakes. His name may have been spelled *La Ramie, Lorimier,* or *La Ramée.* John Elgin Foster

Larceny, *LAHR suh nee,* is the crime of stealing a person's money or other personal property. Larceny is a nonviolent crime. It thus differs from robbery, in which a thief uses violence or the threat of violence to take another's property. Examples of larceny include bicycle theft, pickpocketing, and shoplifting.

The laws of most states of the United States divide larceny into two classes, *grand* and *petty* (sometimes spelled *petit).* In many states, a thief who steals money or goods worth $100 or more has committed grand larceny. A theft of property worth less than $100 is petty larceny. The dividing line between grand and petty larceny in different states varies from $50 to $2,000. The laws of some states classify as grand larceny the theft of automobiles, firearms, livestock, or certain other property, regardless of value.

Grand larceny, a type of crime called a *felony,* is punishable by imprisonment for a year or more. The penalty in most cases of petty larceny, a less serious type of offense called a *misdemeanor,* is a jail sentence of less than a year. Paul C. Giannelli

See also **Burglary; Crime** (tables); **Robbery.**

Larch is a tree that belongs to the pine family. Unlike most trees that have needlelike leaves, larches shed their needles every fall and go through the winter "naked." Such trees are called *deciduous.* Most other trees of the pine family are *evergreens.*

Larches grow throughout the Northern Hemisphere. Three species are native to the United States. It is easy to recognize larches by their needles, which grow in clusters on spurlike branches. Cones grow from some of the buds. Ripe cones are about 1 inch (2.5 centimeters) long. At first, they are a bright red. Then they turn dark red. When ripe, they become chestnut-brown. The cone remains on the trees after the needles have fallen off. Larches are commonly planted as ornamental trees because of their attractive shape and their open, yellow-green crowns.

Eastern larch, often called *tamarack* or *hackmatack,* is a medium-sized tree, reaching heights up to 60 feet (18 meters). Its branches form a narrow pyramid. It grows from Canada through the eastern United States, as far south as Pennsylvania and west to Illinois. It is not important commercially, but its wood is sometimes used as poles. The American Indians used its tough roots to bind their canoes.

Western larch is a large tree, growing up to 150 feet (46 meters) tall. It grows extensively in Oregon, Washing-

ton, Idaho, Montana, and British Columbia, and is commercially important for its lumber. The wood of the western larch closely resembles that of the Douglas-fir. It has an orange-red, scaly bark, and open crowns of light green foliage.

European larch, another important timber species, grows widely in the eastern United States. The *subalpine larch* is a rare, small, timberline tree. It thrives in western sections of the United States and Canada.

Norman L. Christensen, Jr.

Scientific classification. Larches are in the pine family, Pinaceae. They make up the genus *Larix.* The eastern larch is *L. laricina.* The western larch is *L. occidentalis.*

See also **Conifer; Deciduous tree; Evergreen; Pine; Tree** (Needleleaf trees [picture]).

Lard is a solid or semisolid fat obtained by melting the fatty tissues of hogs. Fat from the hog is *rendered* (melted) and strained to remove any bits of flesh or tissue. The lard is then cooled in containers or in firm white blocks, which are later cut into bricks and packaged for sale at grocery stores.

The finest lard comes from fat around the kidneys. This *leaf* lard is the best lard to use for cooking. When fresh, good lard has a mild flavor and a pleasant odor. Good lard is light and almost crumbly in texture.

Lard is a *triglyceride*—that is, a compound formed by an alcohol called *glycerol* and three fatty acids. The acids in lard are oleic acid, palmitic acid, and stearic acid. Lard can be broken down into substances that have important commercial uses. Olein is an oily substance used as a lubricant, as a burning oil, and in the manufacture of margarine. Palmitin is used to make soap and candles. Stearin is used to make soap, ointments, and some kinds of margarine. Helen C. Brittin

Lardner, Ring (1885-1933), was an American journalist who achieved fame as the author of satirical short stories. Lardner wrote his best stories in the language of lower middle-class Americans. The language included grammatical errors, misspellings, and the comical misuse of words. Many of the stories are told by a semiliterate narrator. Lardner's style exposes the lack of culture, inadequate self-knowledge, and selfishness of his characters. At the same time, his best stories are minor masterpieces of humor. Lardner produced three volumes of skillful stories out of the 19 books he wrote. The collections are *How to Write Short Stories (with Samples)* (1924), *The Love Nest* (1926), and *Round Up* (1929).

Lardner was born into a wealthy, cultured family on March 6, 1885, in Niles, Michigan. His full name was Ringgold Wilmer Lardner. He began his career as a reporter at the *South Bend* (Indiana) *Times* from 1905 to 1907. He then held several jobs at newspapers in Boston, Chicago, and St. Louis, leading up to his writing a highly regarded column called "In the Wake of the News" for the *Chicago Tribune* from 1913 to 1919. His syndicated column called "Weekly Letter" (1920-1927) was carried by about 150 newspapers. Lardner established his literary fame with the publication in 1916 of *You Know Me, Al,* a collection of comic letters by a fictional major league pitcher. Many of his stories deal with professional athletes.

In 1919, Lardner moved with his wife and four sons to New York City. Two of his sons, John and Ring, Jr., became noted writers. In New York City, Lardner helped write two plays, *Elmer the Great* (1928) with George M. Cohan and the Broadway hit *June Moon* (1929) with George S. Kaufman. Lardner also contributed sketches and song lyrics to several musicals. Daniel Mark Fogel

Laredo, *luh RAY doh,* Texas (pop. 176,576; met. area pop. 193,117), on the Pan American Highway, is the chief port of entry on the United States-Mexico border. A railroad bridge and three bridges used by motor vehicles link it with its sister city, Nuevo Laredo, in Mexico. Laredo is a large river port. It lies on the Rio Grande, along the southern edge of the state (see **Texas** [political map]). It is an important center of natural gas production and serves as a market for the fruits and vegetables raised on nearby farms in Texas and Mexico. It also ships cattle and manufactures machine tools, hats, shoes, children's dresses, and other products. Laredo is the home of Texas A&M International University.

The city of Laredo was founded by a group of Spaniards in 1755. It then included what are now Laredo and Nuevo Laredo. Laredo and Nuevo Laredo became separate cities in 1848, when the Treaty of Guadalupe Hidalgo established the boundary between Mexico and Texas. Laredo has a mayor-council government. It is the seat of Webb County. Richard L. Deibel

Lares and penates, *LAIR eez, puh NAY teez,* were patron spirits of the home in the religion of ancient Rome. Each household had its protective lar. The penates protected the supplies of the household. The lar was believed to be the spirit of an ancestor. Beginning in the last century before the birth of Christ, households included two lares. Lares were represented as young men in caps and tunics. They were portrayed in statuettes kept in a sacred cupboard called the *lararium* in the entrance hall, or they were painted on a wall. The family made offerings to them following the evening meal.

Every block of houses in Roman cities had its own lar. Romans worshiped these lares at the Festival of the Compitalia, held on January 3. In addition, Rome had its own public lares to protect it from enemies.

Elaine Fantham

Lark is a type of small songbird found mainly in Europe, Asia, and Africa. There are about 75 species of larks worldwide. One species—the *horned lark*—is native to North America. *Meadowlarks* live in North America but are not true larks. They are members of the blackbird family (see **Meadowlark**).

Larks measure from $4\frac{1}{2}$ to 9 inches (11.5 to 23 centimeters) in length. Most larks have dull coloration. They are tan, brown, or gray above, and paler with light spots beneath. In some species, the color of the back varies widely and matches the soil color of the region in which the birds live. For example, *crested larks* that live on the dark, fertile soils of the Nile Delta in northern Africa have dark brown, almost black, backs. Crested larks that live on the sandy deserts of Tunisia have pale tan backs, and those that live on reddish soils in Libya have cinnamon-colored backs. Such *protective coloration* makes it easier for the birds to hide from enemies.

Many larks have a small *crest* (tuft of feathers) on the head. The horned lark has a tuft of black feathers on each side of the head. When erect, the tufts resemble tiny horns. Unlike most songbirds, larks have a long rear toe with a claw that is almost straight.

Larks live in open country, such as deserts, fields, grasslands, and tundras. They spend most of their time on the ground and are good runners. Larks are famous for their song, which they often give while in flight. The male *skylark* begins singing while fluttering upward. He continues his clear, loud song for as long as 10 minutes



WORLD BOOK illustration by Trevor Boyer, Linden Artists Ltd.

The horned lark has two tufts of dark feathers that look like horns growing above and behind the bird's eyes.

while he glides into the wind, high above the ground. The song ends when the lark descends, first gently, then quickly with folded wings.

Most larks eat seeds and insects. On the ground, they build cup-shaped nests out of grass, hair, or pebbles. Females lay two to seven eggs, which vary in color among species and are spotted. The young hatch in 11 to 14 days. David M. Niles

Scientific classification. Larks make up the family Alaudidae. The horned lark is *Eremophila alpestris*.

See also **Bird** (pictures: Birds of grasslands; Birds of Europe and Asia).

Larkin, Philip (1922-1985), was an English poet, novelist, and jazz critic. He became a leading figure in the anti-Romantic movement that dominated English poetry during the mid-1900's. The dominant theme of Larkin's work is the isolation of the poet from a society that he feels to be misguided, but which he is not able to change.

Larkin's first collection of poems, *The North Ship* (1945), deals with the poet's past and exhibits qualities of precise observation and technical control. Larkin gained recognition as a poet with *The Less Deceived* (1955), in which he explored themes of childhood, death, and love in a witty and sophisticated style. Larkin's later volumes of poetry include *The Whitsun Weddings* (1964) and *High Windows* (1974)).

Philip Arthur Larkin was born on Aug. 9, 1922, in Coventry. He studied at Oxford University. His university experiences provided material for his first novel, *Jill* (1946; revised edition, 1964). He also wrote a second novel, *A Girl in Winter* (1947).

Larkin worked as a librarian at the University of Hull from 1955 to 1985. He was a jazz fan and served as jazz critic for an English newspaper from 1961 to 1971. His writings on jazz were collected in *All What Jazz?* (1970; revised edition, 1985). Larkin's essays were published in *Required Writing* (1983). His *Collected Poems* was published in 1988, three years following his death.

Paul B. Diehl

Larkspur is the common name for a group of flowering plants that belong to the crowfoot family. The scientific name for this group of plants is *Delphinium*. Larkspurs grow in the cool regions of both hemispheres. Their name comes from a curved, spurlike growth on the petallike base of each flower. Larkspurs' leaves are finely divided, the lobes spreading like the fingers of a hand.

There are hundreds of larkspurs. The smallest kinds are about 1 foot (30 centimeters) tall, and the larger may grow 7 feet (2.1 meters) tall. Colors range from blue or white to pink or reddish-purple. Some larkspurs can poison cattle. Cases of larkspur poisoning have occurred on Western ranges. Sheep are almost immune to the poison, and horses are only slightly affected. A European larkspur has been used in medicine.



WORLD BOOK illustration by Robert Hynes

Larkspur

Many kinds of larkspurs are grown as ornamental plants. Most grow easily because they do not require any special care. They do best in the open, in rich soil. Most larkspurs are planted from seed in the autumn or early spring, and flower in summer. They grow from an underground stem called a *rhizome* (see **Rhizome**). New plants may be grown from divisions of the rhizome, or from cuttings made from young shoots in spring.

Larkspurs may become infected with a fungus disease known as *sclerotium rot*, which causes the leaves to turn yellow and makes the plant wilt. This disease can be controlled by removing the infected plant and by replacing the earth within a 1 $\frac{1}{2}$-foot (46-centimeter) radius. Larkspurs also can be infected by mildew.

Melinda F. Denton

Scientific classification. Larkspurs belong to the crowfoot family, Ranunculaceae. They make up the genus *Delphinium*.

La Rochefoucauld, *la rawsh foo KOH,* **Duc de** (1613-1680), was a French writer famous for his *Maxims* (1665). This work is a collection of about 500 sayings written to expose the vanity and hypocrisy the author saw underlying behavior. For example, he wrote, "We always love those who admire us, but we do not always love those whom we admire," and "True love, however rare, is still more common than true friendship."

The *Maxims* have been called pessimistic, implying in nonreligious terms the fall into sin that is a part of Christian doctrine. They have also been called a representation of chance and temperament as determining human destiny.

François de La Rochefoucauld was born into a noble family on Sept. 15, 1613, in Paris. In 1652, he was wounded fighting with the nobles against French king Louis XIV in an unsuccessful revolt called the *Fronde.*

Carol L. Sherman

La Rochelle, *lah roh SHEHL* (pop. pop. 80,055; met. area pop. 116,157), is a city on the west coast of France that is famous for its historical religious importance. It lies along the Bay of Biscay, an arm of the Atlantic Ocean (see **France** [political map]).

La Rochelle is France's chief Atlantic fishing port. Its other industries include automobile assembly, distilling, ship construction, and the manufacture of railroad and aircraft equipment. The city is the capital of the Charente-Maritime *department* (administrative district). It is the site of a theater festival each spring. Landmarks include a scenic harbor and a town hall built in the 1500's.

A fishing port since ancient times, La Rochelle was chartered as a city in the 1100's. In the 1500's, French Protestants—called Huguenots—were discriminated against by the country's Roman Catholic majority. But in 1598, the Edict of Nantes established 100 French communities, including La Rochelle, as areas of Protestant security. French Protestants were guaranteed self-rule and religious freedom in the communities. In 1627, the French government demanded the return of the communities to its control. The city withstood a siege by the French Army for 14 months, but its people were finally starved into obedience. Mark Kesselman

Larrazolo, *lah rah SOH loh,* **Octaviano Ambrosio,** *awk tah VYAH noh ahm BROH syoh* (1859-1930), was the first Hispanic American to serve in the United States Senate. Before he became a senator in 1928, he was governor of New Mexico. Larrazolo was a powerful public speaker who worked to protect the rights of Hispanic Americans. He also fought for federal aid to ranchers and farmers and for state rights over the use of public lands. Originally a Democrat, he joined the Republican Party in 1911.

Larrazolo was born on Dec. 7, 1859, in Allende, near Hidalgo del Parral, Mexico. He moved to the United States in 1870. He attended St. Michael's College in Santa Fe. He was a schoolteacher and later a principal in Texas, but he soon became interested in law. He became a lawyer in 1888.

Larrazolo served as governor of New Mexico in 1919 and 1920. He was a state representative in 1927 and 1928, until he was elected to fill a vacancy in the U.S. Senate. He served there from December 1928 to March 1929. Jackie Koszczuk

Larson, Gary (1950-), an American cartoonist, became famous for his single-panel cartoon called "The Far Side." The cartoon gained fame for its bizarre humor. In many of the cartoons, Larson gave human characteristics to animals, insects, and even amebas. Other favorite "Far Side" subjects included professors, scientists, and suburbanites.

Larson was born on Aug. 14, 1950, in Tacoma, Washington. He began his cartooning career in 1978, calling his panels "Nature's Way." The cartoons appeared in *The Seattle Times* for a year but the newspaper withdrew them after reader complaints about their offbeat humor. In 1980, the *San Francisco Chronicle* began publishing and syndicating the cartoon, and the name changed to "The Far Side." In 1984, Universal Press Syndicate became the syndicator.

In 1994, Larson announced he was retiring from drawing "The Far Side," and the last original cartoon appeared on Jan. 1, 1995. However, Larson still supervises the production of previously published cartoons for books, calendars, and other commercial products.

Pamela J. Fehl

See also **Cartoon** (picture: A panel cartoon).

Larva, *LAHR vuh,* is an active, immature stage of an animal. It differs from the adult in such characteristics as structure, behavior, food habits, and environment. An animal's development through egg, larval, and often pupal stages to the adult is called *metamorphosis.*

Larvae occur in the metamorphoses of numerous species, including many insects and water animals. The larva of the sponge is a tiny, oval creature that swims by means of short, hairlike *cilia.* Eventually, it attaches itself to a solid object, and then develops into an almost immobile, adult sponge. Flukes, tapeworms, and roundworms usually have one or two parasitic larval stages.

Marine annelid worms have *trochophores,* or larvae that swim by means of cilia. Many mollusks, including clams, oysters, scallops, and snails, have a free-swimming larva called a *veliger.* Some also have another larval stage, a trochophore similar to that of the annelids. The larvae of freshwater mussels, called *glochidia,* fasten themselves to the gills or skin of fishes and ride about on them. Then they drop off and burrow in the bottom. Many crustaceans, including lobsters and crabs, have active, free-swimming, large-eyed larvae. Barnacles have distinct larval stages called *nauplii* and *cyprids.* These larvae swim and drift great distances before fastening themselves to solid objects and becoming adults. Larvae of many water animals are important food for fishes. They float about as part of the mass of tiny, drifting aquatic organisms called *plankton* (see **Plankton**).

Most insects have larvae more or less distinct from the adults. Larvae that undergo *incomplete metamorphosis* change directly to the adult stage. Such larvae are often called *naiads* if they belong to water insects. If they belong to land insects, they are called *nymphs.* The *caterpillar* of a moth or butterfly, the *grub* of a beetle, the *hellgrammite* of a dobsonfly, and the *maggot* of a fly are insect larvae with *complete metamorphosis.* Such insects pass through a pupal stage before becoming adults. Among the vertebrates, or animals with backbones, many fishes have distinct larvae. For example, eels have ribbon-shaped transparent larvae. Frogs and toads, which are amphibians, have larvae called *tadpoles* or *polliwogs.* Charles V. Covell, Jr.

Related articles in *World Book* include:

Ant lion	Fly	Hellgrammite	Metamorphosis
Bee	Frog	Leafminer	Moth
Caterpillar	Grub		

Laryngitis, *LAR uhn JY tihs,* is an inflammation of the tissues of the larynx, or voice box. It may be caused by various conditions. Sometimes germs invade the tissues and cause them to become inflamed. Doctors believe that laryngitis may result from the use of irritating materials, such as tobacco and alcohol. Breathing irritating substances may also inflame the larynx. Improper use of the voice, which puts extra strain on the larynx and the vocal cords, may frequently cause laryngitis.


Kim Taylor, Bruce Coleman Ltd.

The mosquito larva looks transparent.


© Giuseppe Mazza

The blowfly larva resembles a small worm.


E. R. Degginger

The green frog larva is called a *tadpole* or a *polliwog.* After hatching from an egg, the larva looks like a small fish and lives in the water.


E. R. Degginger

The lacewing larva has many hairy spines, and large jaws with which it captures and eats insects.


E. R. Degginger

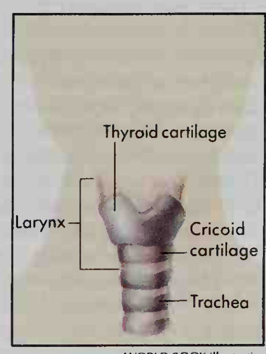
The silkworm larva is called a *caterpillar.* Silk is made from the fibers of its cocoon. Unlike many larvae, it is useful to human beings.

When the inflammation begins, the tissues of the larynx swell. Soon the patient becomes hoarse. If the condition continues, use of the voice may be lost temporarily because the vocal cords become thick and cannot vibrate to produce sound. In severe cases, the swelling may inhibit the passage of air through the larynx. Most cases of laryngitis should be treated by a physician.

Charles W. Cummings

Larynx, *LAR ihngks,* is a section of the air passage in the throat. It is located between the back of the tongue and the *trachea* (windpipe). The larynx is sometimes called the *voice box,* because it contains the vocal cords. Every breath that passes into and out of the lungs passes through the larynx.

The larynx is shaped like a box, and it has a supporting structure made up of nine sections of cartilage. The thyroid cartilage, in front, and the cricoid cartilage, just below it, are the most important. The *thyroid cartilage* consists of two wing-shaped plates that meet to form the projection called the *Adam's apple.* These plates make up the sides of the larynx. The ring-shaped *cricoid cartilage* helps form the back wall of the larynx.



WORLD BOOK illustration by Charles Wellek

The larynx has a framework of cartilage. The thyroid cartilage forms much of the front and side walls of the larynx.

Voice production occurs in the space inside the larynx called the *glottis.* The *vocal cords,* two folds of elastic tissue, lie along the sides of the glottis. Small muscles in the vocal cords are attached to the glottis wall. These muscles can stretch the vocal cords, change their shape, or bring them close together. When the cords are close together, air rushing between them produces sound. The shape and tension in the cords determines the *pitch* (highness or lowness) of the voice. The shape of the throat, nose, and mouth determines the *quality* of a person's voice. Charles W. Cummings

See also the Trans-Vision three-dimensional picture with **Human body;** also **Laryngitis; Voice.**

La Salle, Jean. See Jean Baptiste de La Salle, Saint.

La Salle, *luh SAL,* **Sieur de** (1643-1687), was a French explorer. He led the first European expedition to track the Mississippi River to the Gulf of Mexico. La Salle claimed the entire Mississippi Valley for France. His many explorations strengthened France's hopes for a great empire in the New World.

Early life. La Salle was born in Rouen, France. His real name was René-Robert Cavelier. He took the name La Salle from the name of his family's estate. As a youth, La Salle went to schools run by Jesuit priests and studied to be a Jesuit. However, he left the religious training in 1665 to seek adventure. The next year, La Salle sailed to Canada, where France had established a colony.

La Salle obtained some land near Montreal and became a prosperous fur trader. He did much of his trading with Indians, who told him of two great rivers to the southwest, the Mississippi and the Ohio. The Indians believed these rivers flowed into the sea. La Salle

thought one or both of the rivers might be a route through North America to the Pacific Ocean. In 1669, he sold his land and set out in search of the rivers.


Archives Nationales du Québec
Sieur de La Salle

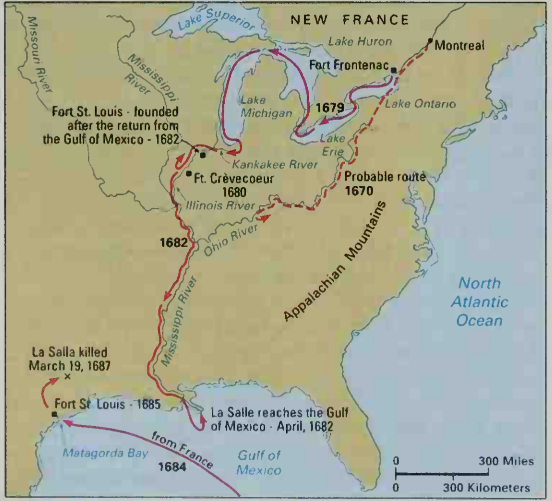
First explorations. From 1669 to 1673, La Salle wandered through the vast interior of North America. Historians believe he traveled as far as what is now Ohio. By the end of his journey, he was convinced the Mississippi emptied into the Gulf of Mexico.

La Salle returned to France in 1674, and King Louis XIV gave him land that included Fort Frontenac, on the site of the present city of Kingston, Ontario. La Salle established a fur trading post at the fort and soon became one of the most powerful persons in Canada. In 1677, he again sailed to France, where he obtained permission from King Louis to explore the Mississippi River.

In 1679, after returning to Canada, La Salle launched an expedition to give France control of the Great Lakes region. The following year, he founded the first European settlement in what is now Illinois. It stood on the Illinois River, near present-day Peoria, and was named Fort Crèvecoeur (Fort Heartbreak). After La Salle built this fort, he went back to Canada for supplies.

Expeditions to the Gulf of Mexico. La Salle returned to the Illinois region in late 1681. Fort Crèvecoeur had been destroyed in a rebellion by some of its occupants, but La Salle pushed on. He led a party of about 20 Frenchmen and about 30 Indians down the Illinois River in canoes to the Mississippi.

The expedition started down the Mississippi River on Feb. 13, 1682, and reached the Gulf of Mexico on April 9. Near the mouth of the Mississippi, La Salle erected a cross and a column bearing the French coat of arms. He claimed all the land drained by the Mississippi and its tributaries for France. This region extended from the Appalachian Mountains on the east to the Rocky Mountains on the west, and from the Great Lakes on the north to the Gulf of Mexico on the south. La Salle named the region Louisiana in honor of King Louis.



WORLD BOOK map

The explorations of Sieur de La Salle through North America strengthened France's hopes for a great empire in the New World. La Salle claimed the Mississippi River Valley for France.

Later in 1682, La Salle built Fort Saint Louis on a bluff along the Illinois River. This bluff is now in Starved Rock State Park. La Salle wanted to establish a colony at the mouth of the Mississippi. In late 1683, he left for France to pick up supplies and settlers for such a colony.

In 1684, La Salle sailed from France for the Gulf of Mexico with 4 ships and over 300 colonists. But this expedition never reached the Mississippi because La Salle sailed past it by mistake. In 1685, he set up a colony, also called Fort Saint Louis, west of the river. This site was near Matagorda Bay, or about 80 miles (130 kilometers) east of the present site of Corpus Christi, Texas.

Indians threatened the new settlement, and many colonists died from disease. By 1687, the colony desperately needed help. La Salle and several men began an overland march to find the Mississippi, which they planned to follow to Canada. But they could not find the river. Some of the men rebelled and killed La Salle's nephew and then murdered La Salle. William Jay Jacobs

See also **Hennepin, Louis; Tonty, Henri de.**

Additional resources

Hargrove, Jim. *Rene-Robert Cavelier, Sieur de La Salle.* Childrens Pr., 1990.

Jacobs, William J. *La Salle.* Watts, 1994. Younger readers.

Muhlstein, Anka. *La Salle.* Arcade Pub., 1994.

Las Casas, *lahs KAH sahs,* **Bartolomé de,** *BAHR toh loh MAY day* (1474-1566), was an early Spanish missionary to Hispaniola, an island in the West Indies. He arrived in 1502 and was ordained a priest there in 1510. He joined the Dominican order in 1524.

Las Casas was one of the first Europeans to defend the rights of the native Indians and worked hard to improve their condition. He especially opposed their enslavement by harsh Spanish masters. Las Casas became known as the "Apostle to the Indians." He published many essays and pamphlets. His most famous work, *The Devastation of the Indies: A Brief Account* (1552), criticizes Spanish colonists for abusing the Indians.

Las Casas was born in Seville. He became bishop of Chiapa in Mexico in 1544. Las Casas returned to Spain in 1547, where he continued his campaign for better treatment of the Indians until his death. James A. De Jong

Las Cruces, *lahs KROO sihs,* New Mexico (pop. 74,267; met. area pop. 174,682), is the trading center for the rich farmlands of the Mesilla Valley. The city lies on the Rio Grande in south-central New Mexico (see **New Mexico** [political map]). The name *Las Cruces* is Spanish for *the crosses.* New Mexico State University and the New Mexico Farm and Ranch Heritage Museum are in the city. The Organ Mountains rise east of Las Cruces, and the White Sands National Monument stands to the northeast. Military proving grounds are located north and south of the monument. *El Camino Real,* the old Spanish colonial road from Santa Fe, New Mexico, to Mexico City, ran through this region. Las Cruces was settled in 1849. The city has a council-manager government. It is the seat of Doña Ana County. Jon Hunner



Chuck O'Rear, West Light

Lasers create an image in a light show.



Hank Morgan, Rainbow

A physician uses a laser to perform eye surgery.



Chuck O'Rear, West Light

A laser beam scans a bar code in a supermarket.



Coherent General, Inc.

A powerful laser beam cuts steel tubing.

Laser beams have special properties that enable them to perform a variety of functions. They are narrow, they spread little, and they can be focused very precisely. The photographs above illustrate some of the many uses of lasers.

Laser

Laser, *LAY zuhr,* is a device that produces a very powerful beam of light. Such a beam can travel over long distances or be focused to an extremely small diameter. Some tightly focused beams can drill 200 holes on a spot as tiny as the head of a pin. Some beams are powerful enough to pierce a diamond, the hardest natural substance. A large laser system can trigger a small nuclear reaction. Laser beams have reached the moon and been reflected back to the earth.

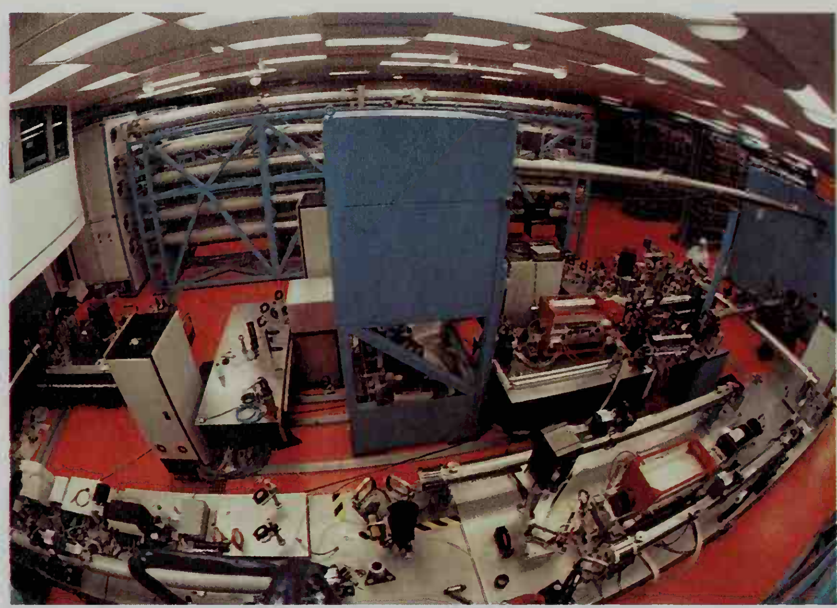
The special qualities of laser light make it ideal for a variety of applications. It can be used to play music, read price codes, cut and weld metal, and transmit information. Lasers can also guide a missile to a target, repair damaged eyes, and produce spectacular displays of light. Other lasers are used to align walls and ceilings in a building or to print documents. Some can detect the slightest movement of a continent.

Lasers vary greatly in size. One is almost as long as a football field. Another type is as small as a grain of salt.

A typical laser has three main parts. These parts are (1) an *energy source,* (2) a substance called an *active medium,* and (3) an *optical cavity,* a structure enclosing the active medium. The energy source supplies an electric current, light, or other form of energy. The atoms of the active medium can absorb the energy, store it for a while, and release it as light. Some of this light triggers other atoms to release their energy. Mirrors at the ends of the optical cavity reflect the light back into the active medium. The reflected light causes more atoms to give off light. The light grows stronger, and part of it emerges from the laser as a narrow beam. Beams can be produced with visible or invisible forms of radiation.

There are many kinds of lasers. They include solid-state lasers, semiconductor lasers, gas lasers, and dye lasers.

In 1960, the American physicist Theodore H. Maiman



University of Rochester, Laboratory for Laser Energetics, NY

Lasers vary greatly in size. A laser used to perform experiments in plasma physics, *left,* fills an area the size of a football field. Tiny lasers, like the one shown among magnified grains of salt, *below,* are built to transmit messages as flashes of light.

built the first laser. Today, lasers rank among the most versatile and important tools in modern life.

How lasers are used

Lasers can do a number of incredible things. Their special qualities make them particularly useful in recording, storing, and transmitting many kinds of information. Lasers also are valuable in such activities as scanning, heating, measuring, and guiding. As a result of their wide use, lasers can be found in equipment used in homes, factories, offices, hospitals, and libraries.

Recording, storing, and transmitting information. Bursts of laser light record music, computer data, and other information as patterns of tiny pits in the surface of special discs. The most common of these discs, *compact discs* (CD's) and *DVD's,* measure about 4 $\frac{3}{4}$ inches (12 centimeters) across. A DVD can hold much more information than a CD can.

Lasers also read and play back the information recorded on these discs. In a *disc player* or *disc drive,* a laser beam reflects off the pattern of pits as the disc spins. Other devices in the player or drive change the reflections into electrical signals, which are translated into music, computer data, motion pictures, and other information. More lasers are used in disc players and drives than in any other product.

Laser beams can produce three-dimensional images in a photographic process called *holography.* The images, recorded on a photographic plate, are known as *holograms.* They appear in advertising displays, artwork, and jewelry, and some are placed on credit cards to prevent counterfeiting.

One of the laser's most important uses is in the field of *fiber-optic communication.* This technology converts the electrical signals that represent telephone calls, television pictures, and computer data into *pulses* (bursts) of laser light. Strands of glass or plastic called *optical fibers* conduct the light. Such a fiber is about as thin as a human hair. But a single fiber can carry as much informa-

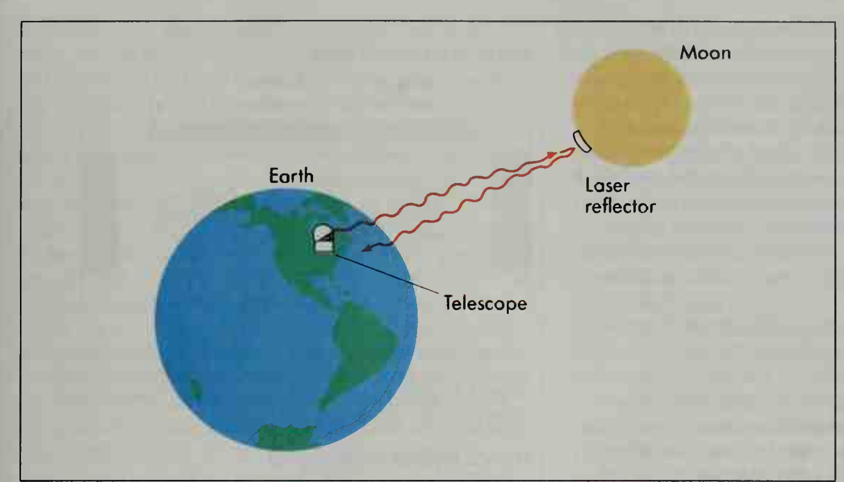


Bell Laboratories

tion as several thousand copper telephone wires. Laser light is ideal for this technology because it can be focused precisely and because all its power can be introduced into the fiber. Laser light can travel long distances within a fiber without diminishing in intensity. However, if needed, a device called a *fiber amplifier* can be used to intensify the laser light within the fiber.

Scanning involves the movement of a laser beam across a surface. Scanning beams are often used to read information. Laser scanners are used at the checkout counters in many stores. What looks like a line of light is actually a rapidly moving laser beam scanning a *bar code.* A bar code consists of a pattern of lines and spaces on packages that identifies the product. The scanner reads the pattern and sends the information to a computer in the store. The computer identifies the item's price and sends the information to the register. Scanners keep track of books in libraries, sort mail in post offices, and read account numbers on checks in banks. Laser printers use a scanning laser beam to produce copies of documents.

In entertainment, laser light shows are created with scanning laser beams. These beams can "draw" spectacular patterns of red, yellow, green, and blue light on buildings or other outdoor surfaces. The beams move so rapidly they produce what looks like a stationary picture. Laser scanners also produce colorful visual effects that create excitement at rock concerts.



WORLD BOOK diagram by Bensen Studios



NASA

The distance to the moon is measured to an accuracy of 5 centimeters by a laser beam sent from the earth, *left.* The beam bounces off a laser reflector, *above,* placed on the moon by astronauts, and returns to the earth.

Heating. A laser beam's highly focused energy can produce a great amount of heat. Industrial lasers, for example, produce beams of thousands of watts of power. They cut and weld metals, drill holes, and strengthen materials by heating them. Industrial lasers also cut ceramics, cloth, and plastics.

In medicine, the heating power of lasers is often used in eye surgery. Laser beams of certain wavelengths can pass through the *cornea* (front surface of the eye) but cause no pain or damage because the cornea is transparent and does not absorb light. Highly focused beams can pass through the cornea and close off broken blood vessels on the *retina,* a tissue in the back of the eyeball. Lasers also can reattach a loose retina. Lasers of a different wavelength can be used to reshape corneas, enabling some people to see clearly without glasses or contact lenses.

Doctors also use lasers to treat skin disorders, remove birthmarks and tattoos, and shatter gallstones. Laser beams can replace the standard surgical knife, or scalpel, in some operations. The use of lasers permits extraordinary control and precision in cutting tissue and sealing off cuts. Thus, lasers reduce bleeding and damage to nearby healthy tissues.

In nuclear energy research, scientists use lasers to produce controlled, miniature hydrogen bomb explosions. They focus many powerful laser beams onto a pellet of frozen forms of hydrogen. The intense beams *compress* (pack down) the pellet and heat it to millions of degrees. These actions cause the pellet's atoms to *fuse* (unite) and release energy. This process, called *nuclear fusion,* may be able to produce enough energy to solve the world's energy problems. Lasers have produced the tremendous heat needed to create fusion but have not yet produced usable amounts of energy.

Measuring. People use lasers to measure distance. An object's distance can be determined by measuring the time a pulse of laser light takes to reach and reflect back from the object.

In 1969 and 1971, United States astronauts placed mirrored devices called *laser reflectors* on the moon. Using a high-powered laser, scientists measured the distance between the earth and the moon—more than 238,000 miles (383,000 kilometers)—to within 2 inches (5 centimeters). They made the measurement by shining laser light from a telescope on the earth to the reflectors.

Laser beams directed over long distances can detect small movements of the ground. Such measurements help geologists involved in earthquake warning systems. Laser devices used to measure shorter distances are called *range finders.* Surveyors use range finders to obtain information needed to make maps. Military personnel use them to determine the distance to a target.

Guiding. A laser's strong, straight beam makes it a valuable tool for guidance. For example, construction workers use laser beams as "weightless strings" to align the walls and ceilings of a building and to lay straight sewer and water pipes.

Instruments called *laser gyroscopes* use laser beams to detect changes in direction. These devices help ships, airplanes, and guided missiles stay on course. Another military use of lasers is in a guidance device called a *target designator.* A person using the device aims a laser beam at an enemy target. Missiles, artillery shells, and bombs equipped with laser beam detectors seek the reflected beam and adjust their flight to hit the spot where the beam is aimed.

How a laser works

Parts of a laser. A typical laser has three main parts. These parts are an active medium, an energy source, and an optical cavity. An active medium is a material that can be made to create laser light. Gases, liquids, solid materials, *plasmas* (electrically charged gaslike substances), and electrons can be used.

An energy source is any type of device that supplies energy to the active medium in a process called *pumping.* Lasers often use electric power, another laser, or a *flash lamp* as an energy pump. A flash lamp produces a bright flash of light, just as a camera flash does.

An optical cavity, also called a *resonator,* is a structure that encloses the active medium. A typical cavity has a mirror at each end. Most often, one mirror has a fully reflecting surface and the other has a partly reflecting surface. The laser beam exits the laser through the mirror with the partly reflecting surface.

Producing laser light. Laser light results from changes in the amount of energy stored by the atoms in

an active medium. The atoms of a substance normally exist in a state of lowest energy, called a *ground state*. Atoms also can exist for a brief time in higher energy states, called *excited states*. Atoms can change from a ground state to an excited state by absorbing various forms of energy. This process is called *absorption*. In many lasers, atoms absorb packets of light energy called *photons*. In most instances, the excited atom can hold the extra energy for only a fraction of a second before the atom releases its energy as another photon and falls back to its ground state. This process is called *spontaneous emission*.

Some atoms have excited states that can store energy for a relatively long time. These long-lived states can last as long as $\frac{1}{1,000}$ of a second. When a photon of just the right amount of energy shines on an atom in a long-lived excited state, it can stimulate the atom to *emit* (give off) an identical photon. This second photon has an equal amount of energy and moves in the same direction as the original photon. This process is called *stimulated emission*. In addition to atoms, molecules, electrons, *ions* (electrically charged atoms), and *excimers* can serve as a medium to produce stimulated emission under proper conditions. Excimers are *diatomic molecules*—that is, molecules consisting of two atoms—that exist only in an excited state and are very short-lived.

Stimulated emission is the central process of a laser. One photon—the stimulating photon—produces another photon. It doubles the amount of light energy present, a process called *amplification*. The word *laser* comes from the first letters of the words that describe the key processes in the creation of laser light. These words are *l*ight *a*mplification by *s*timulated *e*mission of *r*adiation.

Stimulated emission only occurs if there are atoms in the excited state. But atoms in the ground state generally greatly outnumber those in excited states. For amplification to take place, more atoms of a substance must exist in excited states than in ground states. This condition, called a *population inversion*, is created by pumping. The energy pumped into the active medium places atoms in long-lived excited states and enables stimulated emission to occur. The mirrors in the optical cavity reflect the photons back and forth in the active medium.

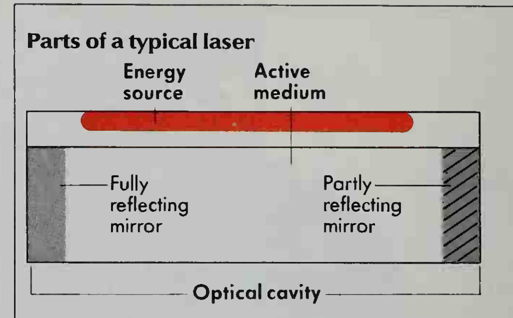
Each interaction of a photon and an excited atom produces a chain reaction of stimulated emissions. This chain reaction causes the number of stimulated emissions to increase rapidly and produce a flood of light. Part of this intense light exits through the partly reflecting mirror as a strong beam.

Characteristics of laser light. Laser light differs from ordinary light in two major ways: (1) it has low *divergence* (spreading), and (2) it is *monochromatic* (single-colored). Light with these two characteristics is known as *coherent light*.

Light from most sources diverges rapidly. Light from a flashlight, for example, fans out quickly and fades after a short distance. But laser light travels in a very narrow beam, even over long distances. For example, a typical laser beam expands to a diameter of only 1 meter after traveling 1,000 meters, or only 64 inches per mile.

Light consists of electromagnetic waves, and the color of light is determined by its *wavelength* (distance from one peak of a wave to the next). Ordinary light consists of waves of many wavelengths—and colors. When all

Parts of a typical laser



A typical laser has three main parts: an *energy source*, a substance called the *active medium*, and an *optical cavity* enclosing the active medium and two mirrors. One mirror reflects only part of the light striking it.

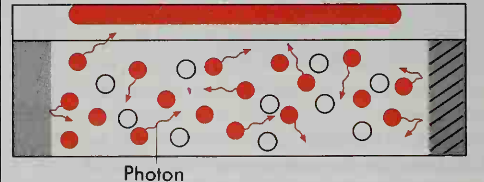
How a typical laser works

Photons

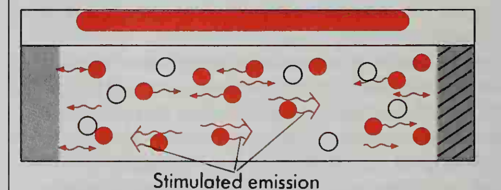
Excited atom

Atom in ground state

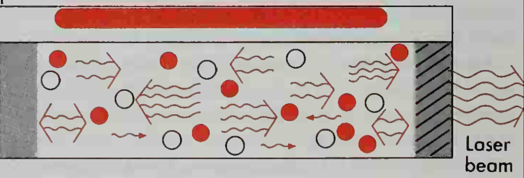
When the laser is turned on, the energy source gives off packets of light energy known as *photons*. Atoms absorb this energy, going from their *ground state* (state of lowest energy) to an *excited state*.



Excited atoms then give off photons. Some of this light reflects off the mirrors and remains in the cavity.



Some photons cause *stimulated emission:* A photon shining on an excited atom causes this atom to give off an identical photon that travels in the same direction.



Stimulated emission increases rapidly. The light becomes so strong that a small part of it exits through the partly reflecting mirror as an intense beam.

WORLD BOOK diagrams by Bensen Studios

these waves are seen together at the same time, their colors appear white—like those from a light bulb. But light produced by most lasers consists of waves with a very narrow range of wavelengths, and so it appears to consist of a single color. Some lasers can produce beams with several different colors, but each color band will be narrow. Some lasers produce such forms of radiation as ultraviolet rays, infrared rays, or X rays.

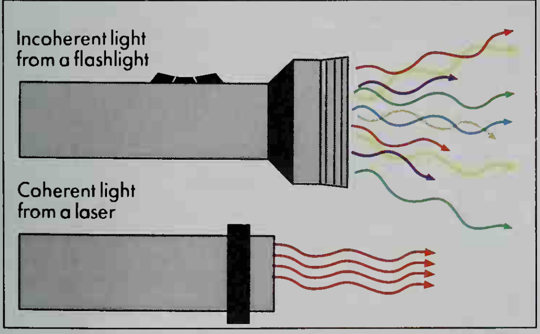
Laser light is highly organized, or *coherent.* The waves of a laser beam move *in phase*—that is, all the peaks move in step with one another. These waves travel in a narrow path and move in one direction. Thus, coherent light is like a line of marchers in a parade moving with the same strides in the same direction. The waves of *incoherent* (ordinary) light, on the other hand, spread rapidly and travel in different directions. Incoherent light acts in much the same way as people walk along a sidewalk—with different strides and in many directions. A laser beam's coherence allows it to travel long distances without losing its intensity.

Kinds of lasers

Lasers produce light either in a continuous beam or in pulses. The lasers that generate pulses, which are called *pulsed lasers,* supply all their energy in only a fraction of a second. As a result, they generally produce much greater peak power than lasers that produce a continuous beam, which are called *continuous-wave lasers.* Most continuous-wave lasers range in power from less than $\frac{1}{1,000}$ of a watt to more than 10,000 watts. But some pulsed lasers can produce beams of trillions of watts for a billionth of a second.

There are four main types of lasers. They are (1) solid-state lasers, (2) semiconductor lasers, (3) gas lasers, and (4) dye lasers.

Solid-state lasers use a rod of a solid material as the active medium. Substances made of crystals or glass are widely used. The most common crystal laser contains a small amount of the element neodymium (Nd) in an yttrium aluminum garnet (YAG) crystal. In some lasers, the neodymium is dissolved in glass. Nd:YAG and Nd:glass lasers are used widely in industry to drill and weld metals. They are also found in range finders and target designators. Flash lamps are generally used to pump solid-state lasers. Sapphire crystals that contain titanium are also used as a solid-state medium. Titanium-sapphire lasers can produce variable wavelengths, a characteristic that is important for many applications. They can generate laser pulses that last only a few quadrillionths (thousandths of a trillionth) of a second.



WORLD BOOK diagram by Bensen Studios

Lasers produce coherent light. Waves of coherent light, unlike waves of incoherent light, move "in step" with one another. As a result, they spread only slightly—even over great distances.

An Nd:glass laser at Lawrence Livermore National Laboratory in Livermore, California, was the world's largest laser. The laser, called Nova, was about as long as a football field. It produced laser light in pulses and was used in nuclear energy research. Nova began to operate in 1985 and was shut down in 1999. It had 10 long, tubular arms, all of which were originally operated together. Nova's light was split into 10 beams, which traveled down the beamlines and could be amplified to focus more than 100 trillion watts of power on a target for a billionth of a second.

The world's most powerful laser was the Petawatt, which later used one of Nova's arms. The Petawatt produced more than 1 quadrillion (1,000 trillion) watts in a pulse lasting less than 500 quadrillionths of a second.

Semiconductor lasers, also called *diode lasers,* use semiconductors, which are materials that conduct electric current but do not conduct it as well as copper, iron, or other true conductors. Semiconductors used in lasers include compounds of metals, such as aluminum, gallium, indium, and arsenic. The semiconductor in a laser consists of two layers that differ in their electric properties. The junction between the layers serves as the active medium. When current flows across the junction, a population inversion is produced. Flat ends of the semiconductor materials serve as mirrors and reflect the photons. Stimulated emission occurs in the junction region.

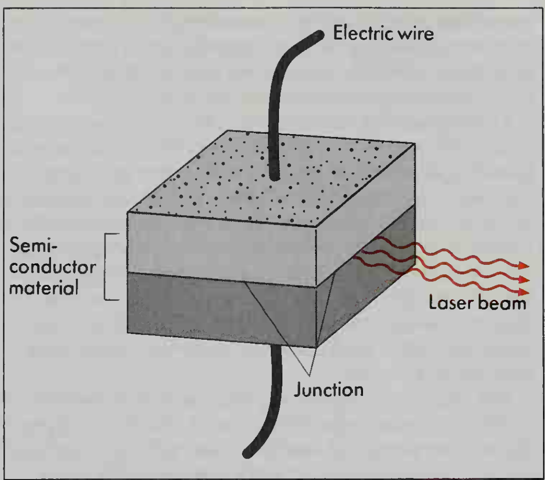
Semiconductor lasers are the smallest lasers. They can be as tiny as a grain of salt. Semiconductor lasers are the most commonly used lasers because they are smaller and lighter and use less power than the other kinds. Their size makes them ideal for use in fiber-optic communications and in CD and DVD players.

Gas lasers use a gas or mixture of gases in a tube as the active medium. The most common active media include carbon dioxide, argon, krypton, and a mixture of helium and neon. The atoms in gas lasers are excited by an electric current in the same way neon signs are made to light. Gas lasers are commonly used in communications, entertainment, eye surgery, holography, printing, and scanning. Many gas lasers produce infrared beams.

Carbon dioxide lasers are among the most efficient and powerful lasers. They convert 5 to 30 percent of the energy from their energy source into laser light. They can produce beams ranging from less than 1 watt to more than 1 million watts. Carbon dioxide lasers are often used to weld and cut metals. They also are used as laser scalpels and in range finders.

Dye lasers use a dye as the active medium. Many kinds of dyes can be used. The dye is dissolved in a liquid, often alcohol. A second laser is generally used to pump the atoms of the dye. The most important property of dye lasers is that they are *tunable*—that is, a single laser can be adjusted to produce monochromatic beams over a range of wavelengths, or colors. Tunable lasers are valuable to researchers who investigate how materials absorb different colors of light.

Other kinds of lasers include excimer lasers, X-ray lasers, and free-electron lasers. Many excimer lasers are used in eye surgery to sculpt corneas. X-ray lasers are



WORLD BOOK diagram by Bensen Studios

A semiconductor laser consists of two layers of material that differ electrically. Electric current passing through the layers produces laser light in the area of their junction.

used to probe and to create images of plasmas, and they can also be used to study the atomic structures of other materials. Free-electron lasers generate high-energy radiation of variable wavelengths. They have applications in the development and processing of metals, plastics, and other materials.

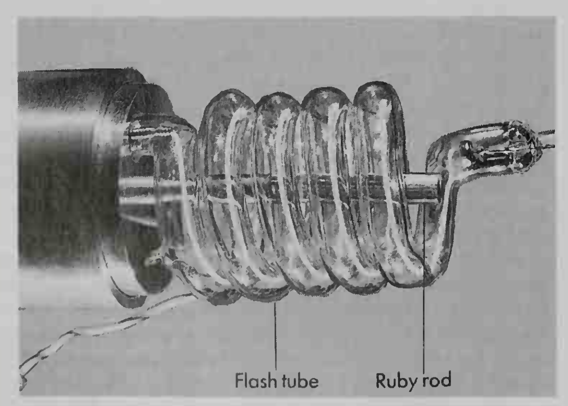
History

Lasers were not invented before the 1900's chiefly because scientists did not know about stimulated emission. The process was first described in 1917 by the German-born physicist Albert Einstein. The next major advance in laser development came in 1954. That year, the American physicist Charles H. Townes created a population inversion in a device that amplified microwaves, an invisible form of radiation. The device was called a *maser* because it demonstrated *m*icrowave *a*mplification by *s*timulated *e*mission of *r*adiation.

During the late 1950's, researchers proposed designs for a device that would use stimulated emission to amplify light. Several people have received credit for developing the laser's basic design. They include Townes, American physicist Arthur L. Schawlow, the Russian physicists Alexander M. Prokhorov and Nikolai G. Basov, and the American inventor Gordon Gould.

Theodore H. Maiman of the United States constructed the first laser in 1960. His laser used a ruby rod as its active medium. Later that year, the American physicist Ali Javan constructed the first gas laser. In 1962, three separate teams of U.S. scientists operated the first semiconductor lasers. In 1966, the American physicist Peter Sorokin built the first dye laser.

Advances in laser technology and uses have soared since the early 1970's. Today, the enormous information-carrying capacity of optical fibers is opening a new era in home entertainment, communication, and computer technology. Even so, researchers remain convinced that the most exciting and revolutionary uses of lasers still lie ahead. David D. Meyerhofer



Hughes Research Laboratories

The first type of laser, *shown here,* used a ruby rod as an active medium and a coiled flash tube as an energy source.

Related articles in ***World Book*** include:

Bar coding
Bomb (Guided bombs)
Compact disc
Crime laboratory (picture: A laser beam)
Fiber optics
Glass (Specialty glasses)
Gyroscope (Laser gyroscopes)
Holography
Maser
Range finder

Outline

I. **How lasers are used**
  A. Recording, storing, and transmitting information
  B. Scanning
  C. Heating
  D. Measuring
  E. Guiding
II. **How a laser works**
  A. Parts of a laser
  B. Producing laser light
  C. Characteristics of laser light
III. **Kinds of lasers**
  A. Solid-state lasers
  B. Semiconductor lasers
  C. Gas lasers
  D. Dye lasers
  E. Other kinds of lasers
IV. **History**

Questions

What is the most important property of dye lasers?
What occurs in the process called *stimulated emission*?
Who built the first laser? When?
Why is the semiconductor laser the most commonly used type of laser?
How are lasers used in medicine?
Why is laser light known as *coherent light*?
What are the main parts of a typical laser?
What is a *population inversion*?
What is the origin of the word *laser*?
What is the world's largest and most powerful laser?

Additional resources

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Laski, Harold Joseph (1893-1950), a British political scientist, achieved fame as an educator and as a leader of the Labour Party. From 1914 to 1920, Laski lectured at universities in Canada and in the United States. He taught at the London School of Economics and Political Science between 1926 and 1950. Laski served on the executive committee of the Labour Party from 1936 to 1949. His books include *The American Presidency* (1940) and *The American Democracy* (1948). The latter became controversial because of its Marxist interpretation of American history. Laski was born on June 30, 1893, in Manchester and attended Oxford. Joseph Martin Hernon, Jr.

Lassen Peak (10,457 feet, or 3,187 meters) is a volcano in northern California, at the southern end of the Cascade Mountains. Lassen Volcanic National Park lies around the volcano. The peak was named for Peter Lassen, who blazed an early trail across its slopes. The volcano erupted several times between May 1914 and June 1917. In May 1915, it produced lava and mud and an explosion that flattened the adjoining forest.

Roger Barnett

See also **Mountain** (diagram: Major mountains).

Lassen Volcanic National Park is located in northeastern California. It includes 10,457-foot (3,187-meter) Lassen Peak. The park was established in 1916. In the park's Chaos region, hundreds of steep domes of lava that were pushed up from below the earth's surface form odd-looking formations. These formations are called Chaos Crags and Chaos Jumbles. Over 40 glacier-made lakes are in the park. Reflection Lake mirrors Lassen Peak. Three large lakes called the Chain-of-Lakes lie in the eastern part of the park. Hot springs bubble on the surface of Boiling Spring Lake. The park is a preserve for many wild animals. For the area, see **National Park System** (table: National parks). See also **Lassen Peak**. Critically reviewed by the National Park Service

Lasso, Orlando di (1532-1594), was a Flemish composer during the Renaissance. His name in Flemish was Roland de Lassus. Orlando di Lasso is the Italian version of his name. Lasso was one of the most productive and versatile composers of his time. He wrote about 500 unaccompanied choral works called *motets,* which are known for their dramatic and expressive qualities. His religious works include the Passion motet *Tristis est anima mea* and the *Seven Penitential Psalms.* His nonreligious music includes choral pieces with texts in French, German, Italian, and Flemish. They range from simple songs to large-scale works for multiple choirs.

Lasso was born in Mons, in what is now Belgium. At the age of 12, he traveled to Italy and Sicily as a singer for the Viceroy of Sicily. In 1556, already known as a composer, Lasso settled in Munich, Germany, at the court of the Duke of Bavaria, becoming his music director in 1563. Joscelyn Godwin

Last Supper. See **Holy Grail; Jesus Christ** (The Passion); **Leonardo da Vinci.**

Las Vegas is the largest city in Nevada and one of the most popular tourist destinations in the United States. It is famous for its hotels, gambling casinos, and 24-hour entertainment. The city attracts about 36 million visitors a year. Las Vegas lies in a valley in southern Nevada.

The city is the county seat of Clark County. It is the center of the fastest growing metropolitan area in the United States. Many people move to the Las Vegas area every month. Large areas of vacant desert in the valley are developed each year.

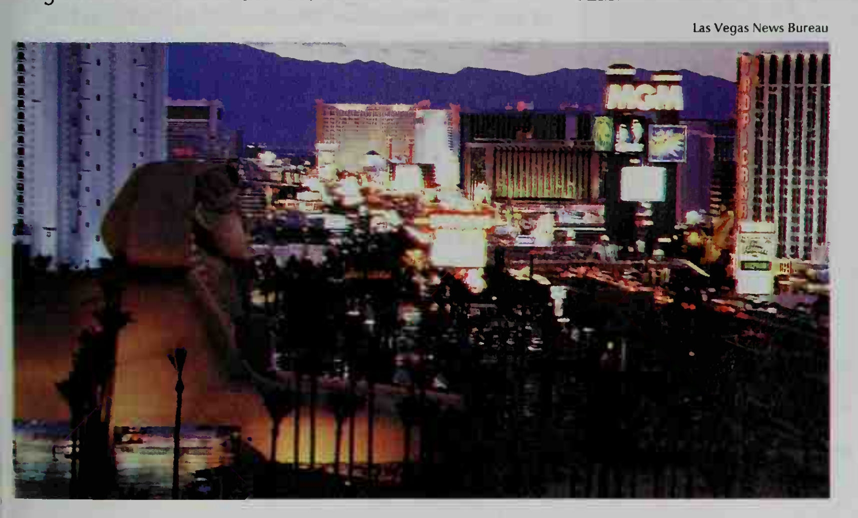
Las Vegas was founded as a water stop for steam locomotives on the rail line between Salt Lake City, Utah, and Los Angeles. The site consisted of grassland fed by springs, and the name of the city comes from two Spanish words meaning *the meadows.*

The city. The bright lights of two Las Vegas streets are world famous. Fremont Street, in downtown Las Vegas, is the major casino-hotel district within the city limits. The Las Vegas Strip, a portion of Las Vegas Boule-

Facts in brief

Population: *City*—478,434. *Metropolitan area*—1,563,282.
Area: *City*—113 mi² (220 km²). *Metropolitan area*—39,370 mi² (101,969 km²).
Climate: *Average temperature*—January, 45 °F (7 °C), July, 90 °F (32 °C). *Average annual precipitation* (rainfall, melted snow, and other forms of moisture)—4 in (10 cm). For the monthly weather in Las Vegas, see **Nevada** (Climate).
Government: Council-manager. *Terms*—Four years for the mayor and the six council members. City manager is appointed by the council and the mayor.
Founded: 1905. Incorporated as a city in 1911.

Las Vegas News Bureau

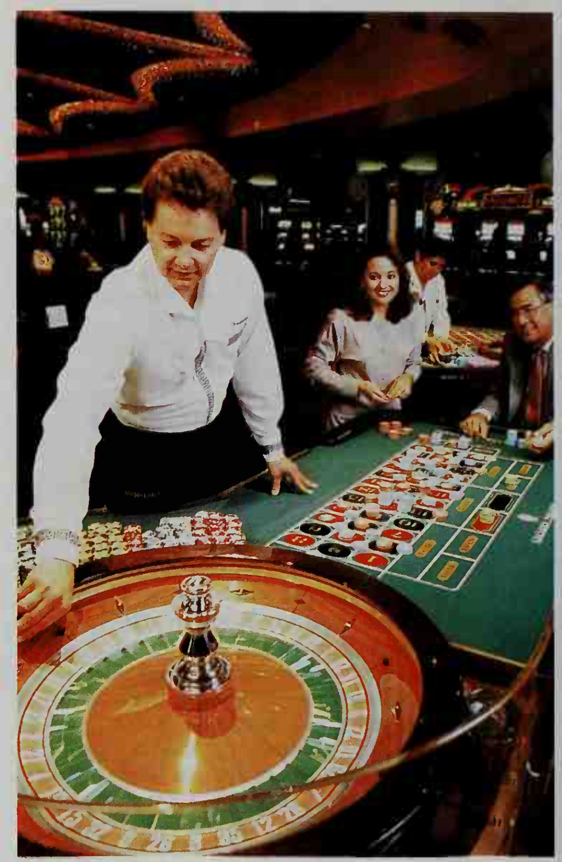


The Las Vegas Strip is best known for its large, luxurious hotels and nonstop entertainment. These attractions have made the city one of the leading tourist destinations in the United States. Las Vegas is Nevada's largest city.

vard just outside the city limits, is famous for its large resort hotels and casinos.

Las Vegas is home to many of the largest and most elaborate hotels in the world. The MGM Grand Hotel/Casino, with over 5,000 guest rooms, is the world's largest hotel. Actors dressed as pirates stage outdoor battles every evening in front of Treasure Island hotel and casino. Ancient Egypt comes to life at the Luxor, a pyramid-shaped hotel complete with a replica of the tomb of the famous King Tutankhamen. Other hotels feature replicas of the Eiffel Tower, the Statue of Liberty, and the canals of Venice.

The Las Vegas metropolitan area includes Clark and Nye counties in Nevada, and Mohave County in Arizona. About half of the urban area popularly referred to as Las Vegas is outside the city limits. Other large cities in Clark County include Henderson, North Las Vegas, and Boulder City. Popular attractions near the city include Hoover Dam, one of the largest dams in the world; and Lake Mead, one of the world's largest artificially created lakes and the main source of water for the metropolitan area. Engineers formed Lake Mead by building Hoover Dam across a canyon of the Colorado River.



Caesars Palace

Casino gambling attracts millions of visitors to Las Vegas every year. The city depends heavily on revenue from taxes on such games as roulette, *shown here.*

People

Ethnic groups. About 70 percent of the city's residents are white, and about 10 percent are African Americans. People of Hispanic descent—who may be white, black, or of mixed ancestry—make up approximately 24 percent of the city's population and are the largest minority group in metropolitan Las Vegas. The city's other population groups include people of American Indian, Asian, or other ancestry.

Education. The Clark County School District operates about 250 public elementary and secondary schools. The area also has about 30 church-supported and other private schools. The University of Nevada, Las Vegas, is the city's best-known institution of higher education. Other schools of higher learning include the Community College of Southern Nevada, with campuses in Las Vegas, North Las Vegas, and Henderson.



Treasure Island at the Mirage

Actors perform an explosive pirate battle outside the Treasure Island hotel and casino. Las Vegas's many themed hotels are popular for family vacations.

Cultural life

The arts. The Las Vegas Philharmonic Orchestra, the Nevada Ballet Theatre, and the Nevada Opera Theatre are among the city's many performing arts organizations. The university hosts an annual series of concerts by visiting orchestras. Hotels offer big-name entertainment and elaborate production shows.

Museums and libraries. The Clark County Heritage Museum in nearby Henderson features exhibits on southern Nevada's history, including an outdoor railroad. Interactive displays at the Lied Discovery Children's Museum provide fun facts about the sciences, arts, and humanities. The Nevada State Museum and Historical Society includes exhibits on the natural history and art of southern Nevada. The Liberace Museum displays many of the famous pianist's showy costumes, rare pianos, and antique cars.

The Las Vegas-Clark County Library District operates many branch libraries throughout the metropolitan area. The University of Nevada, Las Vegas, also has a library.

Recreation. Metropolitan Las Vegas has numerous parks and golf courses. It is one of the few metropolitan areas selected to host two major Professional Golfers' Association of America (PGA) events each year, the Invensys Classic and the Las Vegas Senior Classic. The National Finals Rodeo is held in Las Vegas every December. The city also hosts numerous world championship boxing matches and professional bowling tournaments.

Economy

Industry. Las Vegas depends heavily on tourism and convention business. The tourist industry ranks as the city's largest employer and generates more revenue than any other industry. The Las Vegas Convention Center is the largest single-level convention facility in the United States. More than $3\frac{1}{2}$ million people attend conventions in Las Vegas every year.

The U.S. government is also a major employer in the area. The Nevada Test Site, a nuclear weapons testing facility operated by the U.S. Department of Energy, is north of Las Vegas. Also north of the city is the Nellis Air Force Base, home of a precision flying group called the Thunderbirds, and the Nellis Air Force Range.

Transportation and communication. Las Vegas's McCarran International Airport is the largest airport in Nevada. The city is also served by the Union Pacific Railroad and many trucking lines. Las Vegas has two daily newspapers, the *Las Vegas Review-Journal* and the *Las Vegas Sun.* About 10 regular television stations, 1 cable television system, and over 30 radio stations serve the city.

Government

Las Vegas has a council-manager form of government. The voters elect a mayor and six council members to four-year terms. The mayor and council appoint a city manager to carry out their policies and administer the day-to-day operations of the city. The city's chief sources of revenue include sales taxes, property taxes, and taxes on gambling.

Clark County is governed by seven commissioners who are elected to four-year terms. The commissioners select a county manager to administer county government.

History

Early days. Paiute Indians lived in what is now the Las Vegas area at the time white people arrived. The first non-Indians to settle in the area were missionaries sent by Mormon leader Brigham Young in 1855. The Mormons created a settlement and tried to convert the Paiutes to their religious beliefs. The Mormons abandoned the area in 1858.

Las Vegas was founded in 1905 when a railroad company auctioned off land there. In 1910, the town had a population of about 1,000. It received a city charter in 1911.

Rapid growth. Two developments in 1931 set the stage for rapid growth in Las Vegas. That year, the state legalized casino gambling. Also in 1931, construction began on Hoover Dam, which would supply water and electric power for much of the Pacific Southwest. The dam was dedicated in 1935.

Las Vegas's population had passed 8,400 by 1940. Nellis Air Force Base began as a gunnery school in 1941, during World War II. Las Vegas's first big gambling casino opened in 1946. By 1950, the city's population had almost tripled, reaching nearly 25,000. To attract patrons to the casinos, Las Vegas hotels offered lavish entertainment. Many of the shows featured famous singers, comedians, or other performers, as well as chorus lines of beautiful women in elaborate costumes. By the mid-1950's, gambling and entertainment had made Las Vegas one of the leading tourist attractions in the United States.

By 1960, the city reached a population of about 64,000. The population nearly doubled over the next 10 years as the casino industry continued to prosper. The city's growth prompted the development of the Southern Nevada Water Project (now the Robert B. Griffith Water Project) from 1967 to 1983 to pump more water from Lake Mead.

Recent developments. Las Vegas's population rose from almost 260,000 in 1990 to almost 480,000 by 2000. Many of the problems facing Las Vegas's city government are a result of the rapid population growth. The desert city has a high rate of water usage per person. The metropolitan area's share of water from the Colorado River and Lake Mead is not sufficient for continued growth. The county and city governments helped form the Southern Nevada Water Authority, which is

David Frazier



Modern bungalows in a Las Vegas community stretch out toward the Muddy Mountains. The city's rapidly developing metropolitan area attracts many new residents each month.

working to develop water conservation programs and find new sources of water.

The Las Vegas area's population growth has led to crowded classrooms. In response, the Clark County School District has placed some schools on double sessions or year-round schedules. The population growth also has increased traffic congestion, air pollution, and crime.

Until the late 1900's, gambling was illegal in most parts of the United States outside Nevada. But many state governments then began legalizing some forms of gambling to raise revenues for their operations. In response to the new competition, Las Vegas gaming companies began building larger, themed hotels to attract more visitors. Charles Zobell

See also **Hoover Dam; Lake Mead; Nevada** (pictures).

Latakia, *LAT uh KEE uh* (pop. 312,000), is one of the largest cities and leading trading centers of Syria. It lies on the eastern shore of the Mediterranean Sea (see **Syria** [map]). Latakia is one of Syria's busiest ports. In the 1960's, Syria improved the port facilities to better serve large ships. Latakia also has a major air force and navy base. Since the mid-1970's, a railroad has linked Latakia and the agricultural lands of northeastern Syria. The city is the home of Tishreen University, one of Syria's major universities. Latakia was founded in ancient times and was first known as Laodicea. Christine Moss Helms

La Tène style. See **Celts.**

Lateran Treaty. See **Papal States.**

Latex, *LAY tehks,* is a milky substance that serves as the source of natural rubber. It is produced by plants and trees of the sapodilla family. Most commercially used natural latex comes from hevea tree plantations of tropical Africa and Asia.

Latex is obtained by cutting diagonal grooves in the bark of trees and gathering the material as it drips from these wounds. Because latex quickly decomposes, it must be processed within several hours after being collected. In some cases, it is thinned with water and treated with formic acid to make it *coagulate* (form solid particles). The particles are then rolled into sheets that are smoked and dried before shipping. The smoking kills bacteria and molds that could rot the sheets.

Some latex is shipped as a liquid. Before latex is shipped in this form, much of the water found in it is removed in separators. Ammonia or some other preservative is then added to the remaining latex to slow bacterial decomposition and coagulation. Jim L. Bowyer

See also **Chicle; Guayule; Gutta-percha; Rubber** (First uses; Natural rubber; Synthetic rubber).

Lathe. See **Machine tool** (Turning).

Lathrop, *LAY thruhp,* **Julia Clifford** (1858-1932), was the first chief of the Children's Bureau of the United States Department of Labor. Lathrop became the first woman to head an important U.S. government bureau. A friend of Jane Addams, she worked at Hull House almost from its beginning, first as a county visitor and then as a member of the Illinois State Board of Charities (see **Hull House**). She resigned from the board in 1901, in protest against a political appointment, but was reappointed by a new governor. She served 11 years and helped establish the first Juvenile Court.



Julia Clifford Lathrop

President William Howard Taft called her to the Children's Bureau when it was formed in 1912, and she served as its chief until 1921. The bureau owes its emphasis on research and on qualified child-welfare workers to her. She encouraged states to improve birth registration and to provide aid for mothers to prevent unnecessary removal of their children. She was born in Rockford, Illinois. Alan Keith-Lucas

Latimer, *LAT uh muhr,* **Hugh** (1485?-1555), was a leader of the English Reformation, a movement to establish Protestantism in England. He was one of the English theologians asked by King Henry VIII for support in the king's attempt to *annul* (cancel) his marriage to Catherine of Aragon. The king later named Latimer a royal chaplain. In 1535, Latimer became bishop of Worcester. See **Reformation** (In England).

In 1539, Latimer resigned as bishop because he opposed Henry's insistence on the Six Articles, a document that reaffirmed Roman Catholic doctrine and practice. Latimer, a devoted Protestant, was prohibited from preaching. He again received a license to preach in 1547, when Edward VI became king. Latimer's attacks on religious abuses and social problems made him a popular preacher. He proclaimed the rights of the poor with such bold statements as "The poorest plowman is in Christ equal with the greatest prince that is." In 1553, Queen Mary, a devout Catholic, had Latimer arrested. He was burned at the stake in 1555, along with Nicholas Ridley, another Protestant leader (see **Ridley, Nicholas**). Their *martyrdom* (death for a belief) caused widespread sympathy for all persecuted Protestants.

Latimer was born in Thurcaston in Leicestershire. He studied at Cambridge University and was ordained to the priesthood about 1515. Dale A. Johnson

Latimer, Lewis Howard (1848-1928), was an African American inventor and draftsman. He contributed to the development of incandescent electric lighting.

Latimer was born in Chelsea, Massachusetts. He taught himself drafting and mechanical drawing while employed by a firm of patent attorneys. In the mid-1870's, he provided the drawings for Alexander Graham Bell's patent application for the telephone.

In 1880, Latimer was hired by the United States Electric Lighting Company. There, he patented a method for producing carbon filaments that greatly increased the life of incandescent lights (see **Electric light** [Incandescent lamps]). He also supervised the installation of electric lighting in New York City, Philadelphia, Montreal, and London. In 1883, he began working as an engineer and draftsman for inventor Thomas A. Edison. Latimer wrote the first textbook on the Edison lighting system, *Incandescent Electric Lighting: A Practical Description of the Edison System* (1890). David F. Channell

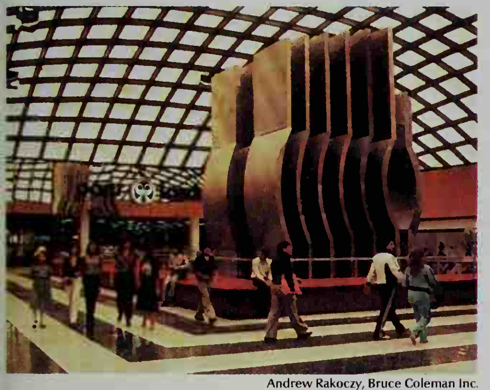
Latin, language. See **Latin language.**


Loren McIntyre

Copacabana Beach in Rio de Janeiro, Brazil


Nicholas Devore III, Bruce Coleman Inc.

Coffee berry pickers in Costa Rica


Andrew Rakoczy, Bruce Coleman Inc.

A modern shopping mall near Mexico City


Odyssey Productions

Farmland alongside Guatemala's Lake Atitlán

City and country life in Latin America contrast sharply. Many city dwellers live and work in sleek, modern buildings. Peasants in the countryside rent or own small plots of land or work on commercial farms. Many poor peasants have flocked to the cities looking for better jobs.

Latin America

Latin America is a large region that covers all the territory in the Western Hemisphere south of the United States. It consists of Mexico, Central America, South America, and the islands of the West Indies. The region is divided into 33 independent countries and 13 other political units. Brazil is by far the largest country in Latin America both in area and in population. It occupies more than 40 percent of the region's land area and has about a third of its people.

During the late 1400's, people from southern Europe, especially Spain and Portugal, began to settle in Latin America. These people brought their own languages, religious beliefs, and customs with them. Today, the majority of Latin Americans speak Spanish, Portuguese, or French, each of which developed from Latin. For this reason, the region is called *Latin America.* English or Dutch is the official language in several areas of the region that were colonized by England or the Netherlands. Scholars disagree about whether such areas should be considered part of Latin America. This article includes these areas in its discussion of the region (see the table *Political units in Latin America).*

Before the first Europeans settled in Latin America, the region had long been inhabited by American Indians. Soon after the Europeans arrived, they began to bring in many black Africans as slaves, especially to the West Indies and some mainland coastal areas. Over the centuries, numerous whites, Indians, and blacks intermarried. Today, most Latin Americans are of mixed ancestry. They are chiefly of Indian and white descent or of black and white descent. Most other Latin Americans are of unmixed Indian, black, or white ancestry.

The people of Latin America share many traditions and values that spring from their common colonial heritage. However, there are great local differences in the way of life throughout Latin America. Such differences

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Steve C. Ropp, the contributor of this article, is Professor of Political Science at the University of Wyoming and the author of Panamanian Politics: From Guarded Nation to National Guard.

largely reflect various combinations of the region's African, American Indian, and European cultural heritage. Differences in the way of life also arise from differences in geography and in economic development from one part of Latin America to another.

Christopher Columbus, an Italian navigator in the service of Spain, reached Latin America in 1492. By that time, Indians had been living in the region for thousands of years. Such Indian groups as the Aztec, Inca, and Maya had developed highly advanced civilizations. The Europeans who followed Columbus to Latin America quickly conquered most of the Indians and established colonies. European rule of Latin America lasted about 300 years.

During the early 1800's, many Latin American colonies gained their independence and became republics. However, the leaders of the new republics lacked the experience necessary to deal with serious social and economic problems. As a result, the new republics did not work as well as many people had hoped. In some Latin American countries, military dictators seized control of the government. Other nations were ruled by a few powerful families who used their positions to increase their personal wealth. Antigovernment protests and violent revolutions occurred frequently throughout Latin America. During the 1900's, civilian and military leaders tried to bring political stability to the region. But in the process, many of these leaders restricted the civil rights of the Latin American people.

Until the mid-1900's, the majority of Latin Americans lived in rural areas. Today, most of the people live in urban areas. The hardships of rural life as well as the belief that expanded job opportunities exist in urban areas have led millions of rural people to seek work in the cities. However, many of these people are uneducated and unskilled. As a result, they cannot find jobs and so continue to live in wretched poverty. The widespread poverty, overpopulation, and patterns of economic change all help create political and social unrest in much of Latin America today.

This article discusses the people, way of life, arts, and history of Latin America. To understand the region more thoroughly, see the *World Book* articles on each of the independent countries and other political units in Latin

Political units in Latin America

Independent countries

Map key	Name	Capital	Official language
C 5	**Antigua and Barbuda**	St. John's	English
H 4	**Argentina**	Buenos Aires	Spanish
B 4	**Bahamas**	Nassau	English
C 5	**Barbados**	Bridgetown	English
C 3	**Belize**	Belmopan	English
F 5	**Bolivia**	La Paz; Sucre	Spanish; Quechua; Aymara
E 6	**Brazil**	Brasília	Portuguese
G 4	**Chile**	Santiago	Spanish
D 4	**Colombia**	Bogotá	Spanish
C 3	**Costa Rica**	San José	Spanish
B 3	**Cuba**	Havana	Spanish
C 5	**Dominica**	Roseau	English
C 4	**Dominican Republic**	Santo Domingo	Spanish
D 3	**Ecuador**	Quito	Spanish
C 3	**El Salvador**	San Salvador	Spanish
C 5	**Grenada**	St. George's	English
C 2	**Guatemala**	Guatemala City	Spanish
D 5	**Guyana**	Georgetown	English
C 4	**Haiti**	Port-au-Prince	French
C 3	**Honduras**	Tegucigalpa	Spanish
C 4	**Jamaica**	Kingston	English
B 2	**Mexico**	Mexico City	Spanish
C 3	**Nicaragua**	Managua	Spanish
D 3	**Panama**	Panama City	Spanish
G 5	**Paraguay**	Asunción	Spanish
E 4	**Peru**	Lima	Spanish; Quechua
C 5	**St. Kitts and Nevis**	Basseterre	English
C 5	**St. Lucia**	Castries	English
C 5	**St. Vincent and the Grenadines**	Kingstown	English
D 6	**Suriname**	Paramaribo	Dutch
C 5	**Trinidad and Tobago**	Port-of-Spain	English
H 6	**Uruguay**	Montevideo	Spanish
D 5	**Venezuela**	Caracas	Spanish

Dependencies

Map key	Name	Capital	Status
B 5	**Anguilla**	The Valley	British overseas territory; some self-government
C 4	**Aruba**	Oranjestad	Self-governing part of the Netherlands
B 3	**Cayman Islands**	Georgetown	British overseas territory
I 5	**Falkland Islands**	Stanley	British overseas territory
D 6	**French Guiana**	Cayenne	Overseas department of France
C 5	**Guadeloupe**	Basse-Terre	Overseas department of France
C 5	**Martinique**	Fort-de-France	Overseas department of France
C 5	**Montserrat**	—	British overseas territory
C 4	**Netherlands Antilles**	Willemstad	Self-governing part of the Netherlands
C 5	**Puerto Rico**	San Juan	United States commonwealth
B 4	**Turks and Caicos Islands**	Grand Turk	British overseas territory
C 5	**Virgin Islands, British**	Road Town	British overseas territory; some self-government
C 5	**Virgin Islands, United States**	Charlotte Amalie	U.S. organized unincorporated territory

Each independent country and each dependency has a separate article in *World Book*.


Latin America
political map
Capital
Other city or town
Mountain
River
Abbreviations on Map
(Fr.)........France
(Neth.)........Netherlands
(U.K.)........United Kingdom
(U.S.)........United States
WORLD BOOK map
UNITED STATES
MEXICO
GUATEMALA
BELIZE
HONDURAS
EL SALVADOR
NICARAGUA
COSTA RICA
PANAMA
CUBA
BAHAMAS
JAMAICA
HAITI
DOMINICAN REPUBLIC
VENEZUELA
COLOMBIA
ECUADOR
PERU
BOLIVIA
CHILE
ARGENTINA
PARAGUAY
URUGUAY
BRAZIL
GUYANA
SURINAME
FRENCH GUIANA (Fr.)
ST. KITTS AND NEVIS
ANTIGUA AND BARBUDA
DOMINICA
SAINT LUCIA
BARBADOS
GRENADA
ST. VINCENT AND THE GRENADINES
TRINIDAD AND TOBAGO
North Atlantic Ocean
North Pacific Ocean
South Pacific Ocean
South Atlantic Ocean
Gulf of Mexico
Caribbean Sea
Tropic of Cancer
North Latitude 20
Equator 0
Tropic of Capricorn
South Latitude 40
West Longitude
ANTARCTICA
Distance scale
0 Miles 1,000 2,000 3,000 4,000 5,000
0 Kilometers 1,000 2,000 3,000 4,000 5,000 6,000 7,000 8,000

America. See also **North America, Central America, South America,** and **West Indies.**

People

Population. Latin America has a population of about 521 million. The population of the region has more than tripled since 1960. The increase in population is due to a high birth rate and improvements in health care, which have led to a decline in Latin America's death rate. About a third of all Latin Americans are under 15 years old.

Latin America covers about 8 million square miles (21 million square kilometers). If the population were evenly distributed throughout the region, there would be only about 67 people per square mile (25 per square kilometer). However, the population is far from evenly distributed. Vast areas of the interior of South and Central America have few or no people. Much of the interior is covered by tropical rain forests. Some dry grasslands, desert areas, and high mountain regions of Latin America are also thinly settled. Most of the people live near seacoasts or rivers or in highland areas that have good farmland.

Some parts of Latin America are extremely crowded. Barbados, Puerto Rico, and a number of other islands in the West Indies rank among the most densely populated places in the world. Other sections of Latin America that are heavily populated include southeastern Brazil and much of Brazil's coast; east-central Argentina; central Mexico; and the northern regions of Colombia and Venezuela.

Ancestry. Latin America has a varied population in terms of ancestry. The main population groups are (1) Indians, (2) whites, (3) blacks, and (4) people of mixed ancestry.

Most Latin American countries have a class system based largely on ancestry. The relatively small upper class consists chiefly of whites. People of mixed ancestry make up most of the middle class. The large lower class consists mainly of Indians or blacks. However, social position is not decided only on the basis of ancestry. Being of Indian, black, or mixed descent does not necessarily restrict a person to low social status. In Brazil and the West Indies, for example, many black people have become prominent in the arts, business, politics, or science. In Mexico, having Indian ancestry is a point of pride for people of all walks of life. On the other hand, being white does not guarantee high social position. White people can be found in all classes. However, there are higher percentages of white people among the lower classes in countries that have small Indian or black populations.

Indians lived in Latin America long before the first white settlers arrived in the late 1400's. The Indians descended from people who migrated to North America from Asia thousands of years ago. The Aztec, Inca, Maya, and other Indian cultures developed advanced civilizations.

The whites soon conquered most of the Indians and forced them to work in mines or on plantations. Millions of Indians died of harsh treatment, in warfare, or of diseases brought by the whites. In some areas of Latin America, the Indian population almost completely disappeared. To survive, many Indians moved to highland areas or remote forest regions. Today, Indians make up a large percentage of the population in Bolivia, Ecuador, Guatemala, and Peru.

People of Latin America

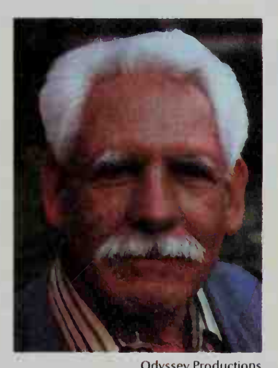
Latin Americans include people of American Indian, European, and African ancestry. *Mestizos* are of mixed Indian and white descent. *Mulattoes* are of mixed black and white descent.


Owen Franken, Stock, Boston
Bolivian Indian woman


Don Cowan, FPG
Ecuadorean Indian man


Porterfield-Chickering, Photo Researchers
West Indies black man


Claus C. Meyer, Black Star
Brazilian white woman


Odyssey Productions
Mexican mestizo man


Claus C. Meyer, Black Star
Brazilian mulatto man

Whites. Most white Latin Americans are of European descent. At first, nearly all the region's white settlers came from Spain or Portugal. But since the early 1800's, Latin America has attracted numerous immigrants from other European nations. Many people from Britain, France, Germany, Italy, the Netherlands, and Poland have settled in Latin America. Today, most of the people of Argentina, Costa Rica, and Uruguay are whites. Brazil and Chile also have large white populations.

Blacks were brought from Africa to Latin America as slaves from the 1500's to the 1800's. Europeans brought millions of black people to work on plantations in the West Indies and in coastal areas on the mainland of Central and South America. Today, most of the people of Barbados, Haiti, and Jamaica are blacks. Many other parts of the West Indies—as well as some tropical lowland areas of Central and South America—also have large numbers of blacks.

People of mixed ancestry. Through the centuries, many whites, blacks, and Indians in Latin America have intermarried. As a result, most Latin Americans are of mixed ancestry. The largest groups are *mestizos* (people of mixed Indian and white descent) and *mulattoes* (people of mixed black and white descent). Mestizos make up a majority of the population in El Salvador, Honduras, Nicaragua, Colombia, Mexico, Paraguay, and Venezuela. Mulattoes are numerous in Brazil, Panama, and the West Indies.

Languages. Most Latin Americans speak the language of the European country that colonized their nation. Nearly two-thirds of the people in Latin America speak Spanish. It is the official language of Cuba, the Dominican Republic, Mexico, and most countries in Central and South America. About a third of all Latin Americans speak Portuguese, the official language of Brazil. French is the official language of Haiti, and Dutch is the official language of Suriname. English is the official language of Belize, Guyana, and other West Indian nations formerly ruled by Britain. Many Latin Americans speak a dialect of their country's official language or a mixture of languages.

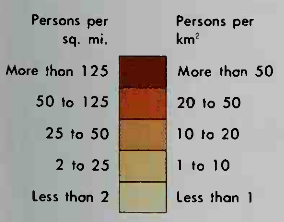
Many Indians in Latin America speak their traditional languages. In Paraguay, an Indian tongue called Guaraní is an official language along with Spanish. Peru's chief Indian tongue, Quechua, is also an official language along with Spanish. Bolivia has three official languages—Spanish, Quechua, and another Indian language called Aymara.

Where the people of Latin America live

The population of Latin America is distributed very unevenly. This map shows that most of the people live near the coasts and in the highland regions of Mexico and the Andes Mountains of western South America. Heavily populated areas are shown in darker colors. The map also shows the location of Latin America's largest cities.

Major Urban Centers

- ● More than 5 million inhabitants
- • 2 to 5 million inhabitants
- o 1 to 2 million inhabitants



WORLD BOOK map

Way of life

Life styles in urban areas of Latin America contrast sharply with those in rural areas. City life moves at a fast pace. Large cities are the centers of political, economic, and intellectual life. They offer a variety of exciting cultural and recreational activities. Although a great many urban dwellers are poor, a growing number of city people enjoy a good standard of living.

Although many peasants continue to live and work on large traditional estates or small personal farms, rural life in Latin America is also changing rapidly. Modern agricultural technologies have been introduced to large parts of the region, and these technologies have encouraged the growth of modern middle-sized farms.

City life. In 1940, about 65 percent of the people of Latin America lived in rural areas. Today, about 70 percent live in urban areas. Four Latin American cities and their suburbs rank among the largest urban centers in the world. They are Mexico City; São Paulo, Brazil; Rio de Janeiro, Brazil; and Buenos Aires, Argentina.

In many ways, large cities in Latin America resemble those in the United States and Canada. Steel and glass skyscrapers rise in busy commercial and financial districts. Tall apartment buildings line broad boulevards. Elegant shops, restaurants, bars, and nightclubs attract large numbers of customers. Cars and trucks jam wide expressways at rush hours. Modern bus and subway systems carry millions of people to and from work.

In the old sections of many Latin American cities, Spanish-style buildings stand crowded together along narrow cobblestone streets. The buildings are made of stone or adobe, and many have decorative iron grillwork over the windows. Government agencies have purchased many such buildings and restored them for use as museums.

Wealthy city dwellers in Latin America include bankers, industrialists, political and military leaders, and owners of large agricultural enterprises who prefer to live in the city. These people make up only a small percentage of the population, but they largely control the economic and political systems in most countries. The rich live in luxurious city apartments or in suburban mansions with swimming pools. Many wealthy people travel widely and send their children to universities in the United States.

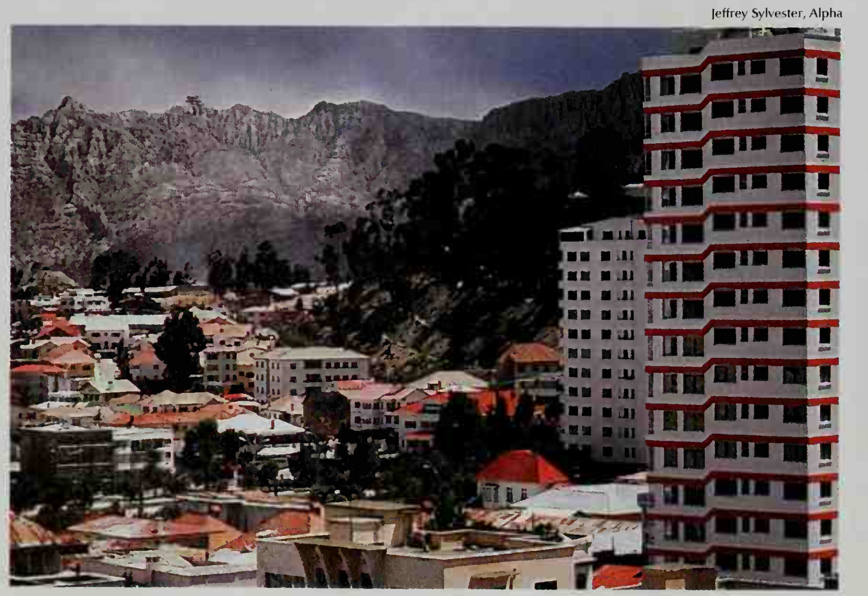
All large Latin American cities have a growing middle class. It consists of professional people, government employees, skilled office and factory workers, and owners of small businesses. Most middle-class families live in comfortable apartments or small single-family houses in the suburbs. They can afford a car, nice clothes, and regular vacations.

Latin America's big cities, like large cities in many other parts of the world, face such serious problems as air and water pollution, overcrowding, housing shortages, and high crime rates. Poverty and unemployment are widespread in Latin American cities. Millions of poor rural people have moved to the cities to look for jobs. Many of these people cannot find work because they lack the necessary skills and education. Most of those who have jobs earn a low income.

Most poor city dwellers live in the slums that surround many of Latin America's large cities. In some cities, more than a fourth of the people live in slums. Families live crowded together in shacks made of cardboard, wood, and tin on land they do not own. Most slums lack electricity, running water, and sewers. Millions of slum children have been abandoned by their parents because they cannot feed or clothe them. These homeless children wander the streets and must beg, steal, or take odd jobs to survive.

A number of Latin American governments have torn down slums and replaced them with low-cost public housing. But in many cities, the construction cannot keep up with the rapidly increasing urban population.

Jeffrey Sylvester, Alpha



Middle-class housing in Latin America consists of modern apartment buildings and comfortable single-family homes. Latin American cities have a growing middle class. The small and large apartment buildings at the left are in a middle-class neighborhood in La Paz, Bolivia.

Many governments are trying to encourage industrial growth in smaller cities to ease the pressure on large urban areas. Public youth centers have taken in many abandoned children. But slums, overcrowding, and poverty remain serious problems.

Rural life. About 30 percent of all Latin Americans live in rural areas. The majority of them are poor farmers, often called *campesinos* in Spanish. Most campesinos in the West Indies and tropical coastal areas of the mainland are blacks. They work on plantations that grow bananas, sugar cane, or cotton. Most campesinos who live inland on the mainland are mestizos. Some work on highland coffee plantations or migrate to coastal areas to work on large commercial farms. At home, most rent or own small plots on which they raise crops and livestock to feed their families. They often cannot afford machinery and so use hand tools to work their land.

Many campesinos live in small villages. Early each morning, they walk or ride buses or trucks from their village homes to the fields. Some villages consist of only a few houses crowded together. Larger settlements have a church, a few shops, and government buildings around a public square called a *plaza*. People gather in the plaza for socializing, entertainment, and ceremonies. Many villages also have an open-air market, where people gather on the weekend to buy or sell food or handmade goods and to exchange news.

Most rural houses in Latin America have one or two rooms. In tropical areas, the houses may have walls of wood or dried mud and sticks, dirt floors, and thatch or tin roofs. In mountain villages, most houses are built of stone or adobe and have red tile roofs. On their estates, wealthy landowners live in luxurious mansions. However, many landowners hire managers to run their farms and spend most of their time in cities.

In general, rural people have a much lower standard of living than do city people. Many rural families do not have such conveniences as electricity, indoor plumbing, or a telephone. In addition, many villages lack adequate schools and medical facilities.

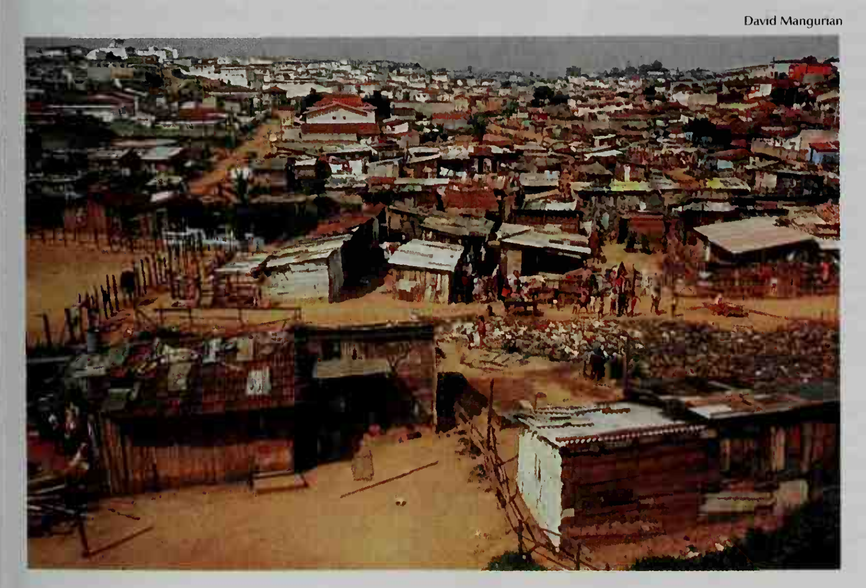
The uneven distribution of wealth in Latin America's rural areas has led to serious social and economic problems. In a majority of countries, a small number of wealthy people, together with owners of modern middle-sized farms, own nearly all the choice farmland. Most campesinos own no land. Those who own or can rent small plots scratch out a living from the poor soil. Despairing of getting ahead in the country, many campesinos have flocked to the cities to seek jobs.

Since the mid-1900's, many Latin American governments have tried to improve rural life so that people will not move to already crowded cities. Some governments have established land reform programs that buy large estates and divide them into small plots for distribution to poor farmers. Many governments have built roads and extended electricity and other modern conveniences to thousands of towns and villages. The improved roads have opened up some uninhabited areas to settlers. Since the 1960's, many families have moved from economically depressed rural areas to new settlements. However, a number of the settlements failed because of the high cost of making the poor soil more productive.

Family life has always been extremely important in Latin American culture. Strong feelings of loyalty and cooperation bind together not only parents and children but also grandparents, aunts, uncles, and cousins. Such feelings are often shared with friends and business associates. This *extended family* provides its members with financial help, security, and social life.

The typical Latin American household consists of parents, children, and grandparents. Some households also include other family members. Generally, the man who contributes most to the family's economic support acts as head of the household. However, women make most household decisions. Children learn obedience to-

David Mangurian



Sprawling slums surround many large Latin American cities. Such areas have grown as millions of poor rural people have moved to the cities to seek a better life. At the left, many poor families live crowded together in crude wooden shacks in a slum in São Paulo, Brazil.



Odyssey Productions

Preparing tortillas (flat bread made from corn or wheat flour) is a daily task for these Mexican women. Many people in Mexico and Central America eat tortillas at every meal. Most Latin Americans cannot afford meat often, and grain is their chief food.



Chip and Rosa Maria Peterson

Outdoor markets like this one in Riobamba, Ecuador, can be found throughout Latin America.

ward their parents, and both children and adults are expected to show respect for their elders.

Traditionally, only Latin American men were expected to have jobs outside the home. Women remained at home to care for their families. Many women, especially in rural areas, still follow this tradition. Since the mid-1900's, however, increasing educational and career opportunities have become available to women. As a result, a growing number of women, particularly in urban areas, now work outside the home. By the early 1960's, women in all Latin American countries had gained the right to vote. Some women take an active role in politics, and women have held high government posts in several Latin American countries.

Among Indians and blacks in Latin America, feelings of loyalty and kinship typically extend beyond the family to the community. Most Indians and blacks are extremely proud of their ethnic heritage. Many live in small communities and work for common goals instead of personal enrichment. Many Indians and blacks take more pride in being a member of their ethnic group or tribe than in being a citizen of their country.

Clothing. Clothing styles in Latin America vary from region to region, depending on climate and custom. Many city people wear clothing like that worn in the United States and Canada. But many villagers prefer traditional clothing styles. On holidays and other special occasions, many Latin Americans wear traditional costumes, which commonly feature bright colors and bold patterns. For pictures of these traditional costumes, see the article Clothing.

Rural Latin Americans who live in tropical climates prefer lightweight cotton clothing. Men usually wear loose-fitting shirts. Most women dress in long skirts and blouses. People in mountain villages need heavier clothing for protection against the cold. Both men and women wear *ponchos* (blankets with a slit in the middle for the head). Women also dress in full skirts and long-sleeved blouses. They commonly drape brightly colored shawls around their shoulders. In the highlands, men wear coarse handwoven shirts and baggy pants. Farmers wear straw or felt hats for protection against the sun while working in the fields. Rural people generally go barefoot or wear sandals, many of which have soles made from old automobile tires.

Clothing styles in some parts of Latin America are highly distinctive. For example, Indian women who live in the highlands of Bolivia wear black derbies. The *gauchos* (cowboys) of Argentina and Uruguay dress in ponchos, baggy trousers tucked into low boots, and wide-brimmed hats.

Many Indian groups wear brightly colored clothing with traditional patterns. Among such groups, each village has its own special colors and designs, which have been used for hundreds of years. Numerous Indian women wear braided belts around their waists. They often use the belts as headbands to hold in place bundles that they carry on their heads.

Food and drink. Grain is the chief food of most Latin Americans. Many people in Mexico and Central America serve *tortillas* (flat bread made from corn or wheat flour) at most meals. Beans and rice form a major part of the diet of most West Indians. People who live in the mountainous areas of South America commonly eat potatoes. People in tropical areas eat a starchy root called *cassava*. In Argentina and Uruguay, people eat many foods made from wheat.

Most Latin Americans eat little meat because they cannot afford it. But people eat a great deal of beef in the cattle-raising countries of Argentina and Uruguay. People who live along rivers or near the oceans commonly eat fish and shellfish. Many Latin American dishes are highly seasoned with onions and hot peppers. In tropical areas, the people enjoy such fruits as bananas, mangoes, oranges, and pineapples. Latin Americans drink coffee, a variety of fruit juices, and a kind of tea called

maté. Favorite alcoholic beverages include beer, rum, wine, and *aguardiente*, a brandylike drink made from sugar cane.

Middle- and upper-class Latin Americans enjoy a much wider choice of food than poor people can afford. They regularly eat a variety of meats as well as other fresh and processed foods. The diet of most poor people in Latin America consists mainly of starchy foods and lacks important nutritional elements. Many poor Latin Americans in rural areas and urban slums suffer from malnutrition.

Recreation. Latin Americans enjoy a wide variety of outdoor activities. Soccer is the region's most popular sport. Many boys and girls begin playing soccer as soon as they can walk. Hundreds of thousands of spectators jam huge stadiums throughout Latin America to watch professional soccer games. Soccer stars have become national heroes. The Brazilian star Pelé won fame as the world's greatest soccer player in the 1960's.

Baseball is especially popular in parts of the West Indies and in mainland countries that border the Caribbean Sea. A number of Latin Americans have become stars on professional baseball teams in the United States and Canada. Cricket is popular in the Bahamas, Jamaica, and Trinidad and Tobago. Bullfights draw large crowds in Colombia, Mexico, Peru, and Venezuela. Other popular sports include automobile racing, basketball, horse racing, and volleyball.

In coastal areas, large crowds regularly flock to beaches on weekends. Favorite activities include boating, fishing, swimming, surfing, and water-skiing. Many families take overnight camping trips to national forests. During the winter months, well-to-do people enjoy skiing at beautiful mountain resorts.

Latin Americans take part in a number of other leisure activities. Visiting with family and friends is a major pastime. Many people enjoy listening to the radio or watching television. In cities, popular pastimes include visiting parks and museums and attending plays, concerts, and motion pictures. Large numbers of Latin Americans take part in colorful *fiestas* (festivals), which are held on national or religious holidays. Many fiestas feature colorful parades with richly decorated floats, costumed street dancers, lively musical performances, games, and fireworks.

Religion. Most Latin Americans are Christians. The great majority are Roman Catholics, but a growing number belong to Protestant churches. The laws of all Latin American countries guarantee freedom of worship, though some countries officially support the Roman Catholic Church. Other religious groups in Latin America include Buddhists, Hindus, and Jews. Some Indian and black peoples worship the gods of their own cultures.

Roman Catholicism. The early Spanish and Portuguese explorers brought the Roman Catholic religion to much of Latin America and converted many Indians to Catholicism. Today, about 80 percent of the people belong to the Roman Catholic Church. However, the number of Catholics who actively practice their religion varies from country to country. Many Latin Americans of Indian or black African ancestry combine Catholic religious practices with spiritual beliefs of their own traditions.



Robert Frerk

Soccer is the favorite sport in Latin America. Many of the region's large cities have huge stadiums, like this one in Mexico City, which draw overflow crowds for championship matches.

In some Latin American countries, the Roman Catholic Church greatly influences the daily lives of the people. Church officials represent a wide range of political opinion and participate in all levels of government. They take an active role on zoning and planning boards and in human welfare agencies. In addition to performing their religious duties, many neighborhood and village priests work for social reforms on behalf of the poor in their districts.

During European rule, the Roman Catholic Church exercised great political power throughout Latin America. The Catholic Church also dominated education and owned huge estates and other property. During the early 1800's, many Latin American colonies won their freedom. Some members of the clergy supported the independence movement. However, many others opposed it. After independence, many Latin American governments took steps to decrease the Catholic Church's power. They seized much of its property and limited or took away its control of education, hospitals, cemeteries, and public charities.

During the early 1900's, the Catholic Church became closely linked to military leaders and wealthy landowners who controlled many Latin American governments. Since the late 1960's, however, the church has become increasingly active in the fight for civil and human rights and social justice. Many Catholic officials have sharply criticized Latin American governments for failing to provide adequate services for the poor. This criticism has led to serious clashes between religious and political leaders in a number of countries. See **Roman Catholic Church** (In Latin America).

Protestantism. Protestants make up about 5 percent of Latin America's overall population, though they comprise a greater percentage in some countries than in others. Latin American Protestants include Baptists, Episcopalians, Lutherans, and Methodists. Many Protestants live on West Indian islands formerly ruled by Britain and in the Netherlands Antilles.

Since the late 1960's, millions of Latin Americans have joined a variety of churches based on *Pentecostalism.* Pentecostalism is an emotional form of worship that emphasizes prayer (see **Pentecostal churches**). Most new members of Pentecostal churches are former Catholics who had quit practicing that religion. Many of them disagreed with the Catholic Church's active involvement in social reform movements. The Church of Jesus Christ of Latter-day Saints has also won many converts. It and the Pentecostal churches are the fastest-growing religious groups in Latin America.

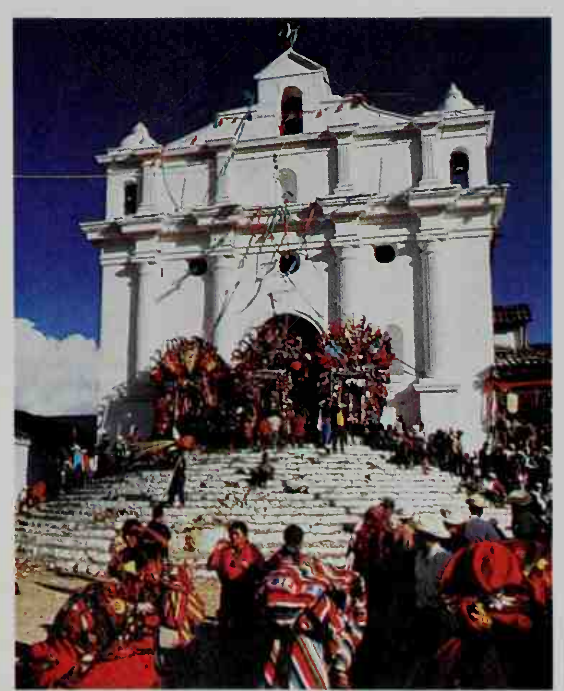
Education in Latin America has improved greatly since 1960. Larger percentages of Latin Americans than ever are attending elementary schools, high schools, and colleges. In many countries, the *literacy rate* (percentage of people aged 15 or older who can read and write) has increased enormously. In such nations as Argentina, Chile, Cuba, and Uruguay, the literacy rate is more than 90 percent. Many governments have set up programs to teach uneducated adults to read and write. In spite of the progress in education, serious problems remain. In such countries as Guatemala and Haiti, the literacy rate is less than 60 percent. Throughout Latin America, educational levels are generally lower in rural areas than they are in the cities.

Nearly all Latin American nations require children to complete elementary school. But many students, particularly in rural areas and urban slums, cannot fulfill this requirement because of a shortage of schools, educational materials, and qualified teachers. Numerous other students must leave school after a few years to look for work and help support their families. All Latin American governments have built schools and sponsored programs to extend education to more people. However, the population is growing faster than schools can be built or teachers trained. In addition, the costs of education are constantly increasing.



Milt and Joan Mann

Public education has become increasingly available to Latin Americans since 1960. The high school students above are attending a chemistry class in Oruro, Bolivia.



George Holton, Photo Researchers

Religious festivals, called *fiestas,* are an important part of Latin American life. These Guatemalans, wearing colorful traditional costumes, are celebrating the fiesta of Saint Thomas.

In many Latin American countries, students can receive a free public education from kindergarten through college. However, large numbers of students, especially from middle- and upper-class families, go to private schools, which charge tuition. The private schools also receive government funds. The Catholic Church operates many private schools in Latin America. For many years, private schools provided a better education than did public schools. But increased financial support has enabled many public schools to offer an education at least equal to that of private schools.

Latin America has a number of excellent public and private colleges and universities. Four of the universities date from the 1500's. Santo Domingo University in the Dominican Republic was founded in 1538. It is the oldest institution of higher learning in the Western Hemisphere. The National University of San Marcos in Lima, Peru, and the National Autonomous University of Mexico in Mexico City date from 1551. Saint Thomas University in Bogotá, Colombia, dates from 1580.

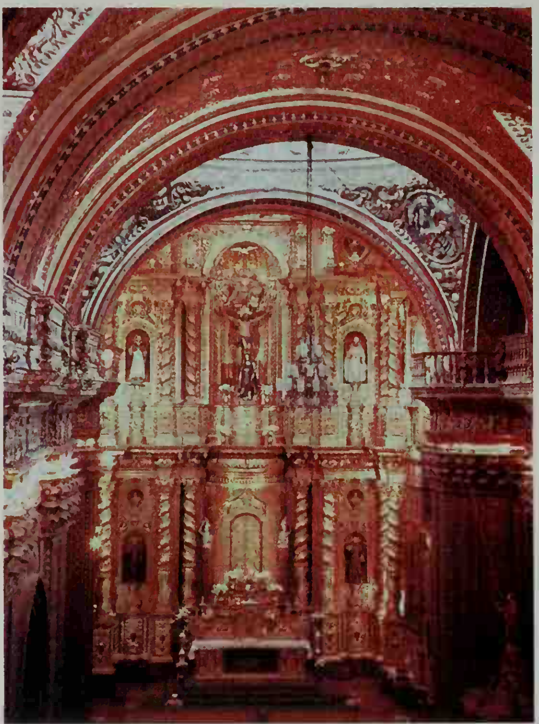
Enrollment in Latin America's colleges and universities has increased greatly since the 1960's. In several nations, the number of qualified high school graduates who want to attend public universities exceeds the number that these schools can enroll. Many Latin American countries have a shortage of skilled workers, scientists, teachers, and other professionals. To meet the need for such workers, many nations have built technical schools that prepare young people for careers in agriculture, business, and engineering.

Latin America has some fine public and school libraries. For information about libraries in Latin America, see **Library** (Libraries in Latin America).

The artistic traditions of Latin America date back thousands of years to the region's ancient Indian cultures. The ruins of magnificent temples and other structures built by advanced Indian civilizations still stand in such countries as Mexico, Peru, and Guatemala. The Indians also produced beautiful textiles, jewelry, pottery, and other handicraft items. When Spanish and Portuguese colonists began arriving in Latin America during the late 1400's, they brought their European artistic traditions with them. European styles dominated the region's arts for hundreds of years. After the colonists imported black slaves, African traditions influenced such arts as popular music and dancing. During the 1800's and 1900's, various Latin American arts began to develop a strong national character, rather than reflect European styles.

Architecture. Highly developed Indian civilizations constructed enormous buildings and impressive cities before the first Europeans reached Latin America. The greatest Indian architects were the Aztec and Toltec in Mexico, the Maya in Mexico and Central America, and the Inca in the Andes Mountains of western South America. The outstanding Aztec, Maya, and Toltec structures were huge stone pyramids topped by temples. Inca architects designed cities that clung to mountainsides. The stones for Inca buildings were cut so precisely that they fit together without cement. See **Architecture** (Pre-Columbian architecture).

The first major buildings constructed by Europeans in Latin America had a religious or governmental purpose. Some of the finest structures were huge cathedrals and sprawling monasteries that included a church, chapels, living quarters, and a courtyard surrounded by high, thick stone walls. Beginning in the late 1600's, many cathedrals, palaces, and mansions were built in the *baroque* style of architecture. This style featured elaborately carved columns, ornate sculptures, and lavish use of colored tile, gold, and silver.



Tom Hollyman, Photo Researchers

Magnificent religious architecture of the colonial period can still be found in many Latin American churches. The elaborate interior above is in La Compañía, a cathedral in Quito, Ecuador.



Fred Fehl

Spectacular folk dances are performed by the Ballet Folklórico of Mexico. The company preserves the traditional dances of the Indians of Mexico and the settlers from Spain.

Modern Latin American architecture combines simple geometric forms with bold decorations and curving shapes inspired by the region's Indian and baroque heritage. Many architects cover all or part of their buildings with stunning paintings or *mosaics* (designs or pictures made of pieces of stone or other material). Such buildings can be found at the National Autonomous University of Mexico in Mexico City and at the Central University of Venezuela in Caracas. The great Brazilian architect Oscar Niemeyer created strikingly modern designs for buildings in Brasília, the capital of Brazil.

Literature. Latin American literature includes works by writers from the Spanish-speaking countries and Puerto Rico and from Portuguese-speaking Brazil. For a discussion of the region's rich literary tradition, see **Latin-American literature**.

Painting. Precolonial Latin American painting includes brilliantly colored murals by Indian artists. Some of these murals decorate temples and feature lifelike fig-

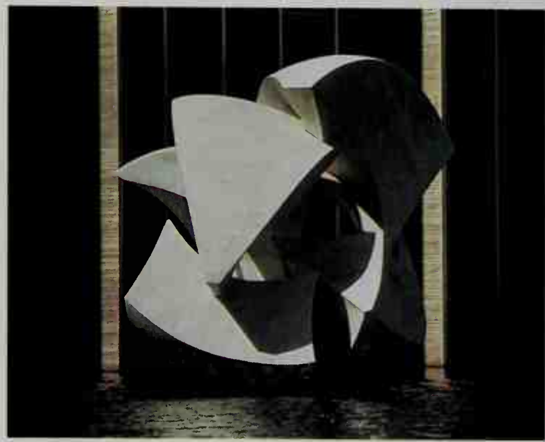
ures taking part in battles and ceremonies. Some Indian groups also painted pottery and sculptures.

During colonial times, many Latin American painters imitated European styles. Most artists painted pictures with religious themes for churches and cathedrals. The leading centers of painting during the colonial period included Mexico City; Quito, Ecuador; and Cusco, Peru.

About 1900, Latin American artists began to develop painting styles that were distinctly Latin American. Many of them adopted the vivid colors and bold designs that stemmed from the region's Indian heritage. Such Mexican artists as José Clemente Orozco, Diego Rivera, and David Siqueiros became famous for their gigantic murals. The murals portray scenes from Mexican history, especially the struggle for independence and Mexico's 1910 revolution. The Brazilian painter Cândido Portinari used modern abstract styles to create powerful pictures of everyday life in Brazil. In Haiti, an outstanding group of self-taught artists, including Hector Hyppolite and Philomé Obin, has produced imaginative scenes of local life and folklore.

Sculpture. Before the Europeans arrived, Latin American Indians created many beautiful sculptures, ranging from masks and statuettes to huge, elaborately carved panels and monuments. Indian sculptors carved a large number of their works from stone, but they also used clay, jade, gold, and wood. Many of their sculptures depicted gods and religious symbols and were used to decorate temples and religious centers. See **Sculpture** (Indian sculpture of the Americas).

Early colonial sculpture consisted mainly of architectural decoration on churches. Much of the carving was in the *plateresque* style, a form of stone design that resembled the delicate work of *plateros* (silversmiths). The Brazilian sculptor Antônio Francisco Lisbôa, also known as Aleijadinho, created some of the finest works of the late 1700's and early 1800's. He carved magnificent religious figures from wood and stone for churches in the Brazilian state of Minas Gerais.



Loren McIntyre

Modern Latin American sculpture differs greatly from the ornate style of colonial times. This marble work, titled *Meteor,* was made in the 1960's by Bruno Giorgi, a Brazilian sculptor.

Since the mid-1800's, much Latin American sculpture has reflected a strong national pride and a growing interest in the region's Indian heritage. Many sculptors have produced impressive monuments to heroes of Latin America's revolutions and wars of independence.

Music. Latin Americans enjoy many kinds of music. Street performances of live music are common in the region. Performances of traditional Indian and black music and Western classical music draw large crowds. Rock music is also popular among young Latin Americans.

Indian music of Latin America dates from precolonial times. It played a major part in most Indian ceremonies and remains important in areas that have a large Indian population. European settlers introduced Western musical forms and instruments into Latin America. *Mestizo*

The People Go to the University—the University Goes to the People (1956); Carter, Black Star



Colorful Mexican murals became internationally famous during the 1900's. This mural by David Siqueiros decorates the Administration Building of the National Autonomous University of Mexico in Mexico City.



Coumbite (1971), an oil painting on masonite by Gerard Valcin; Flagg Tanning Corporation

Latin American painting by self-taught artists in Haiti draws upon themes from local life and folklore. The painting above shows workers on a Haitian plantation.

music combines Indian tunes with lively Spanish strains. Music in the West Indies and coastal mainland areas reflects African traditions introduced by black plantation slaves. Complicated African rhythms can be heard in the *calypso* music of Trinidad and in the *samba* and *bossa nova* styles of Brazil.

In playing traditional Latin American music, musicians use various special instruments. These instruments include wooden and steel drums; the *cuatro* (a four-stringed guitar); the *marimba* (an instrument similar to the xylophone); and *maracas* (rattles made from gourds). Much traditional music also features flutes, harps, horns, violins, and tambourines.

Many large cities in Latin America have symphony orchestras, chamber groups, and opera companies. These organizations perform the work of the great European classical composers. European styles strongly influenced the region's classical music until the 1800's. A number of Latin American composers then began to express their national heritage in their music. During the 1900's, such internationally known composers as Heitor Villa-Lobos of Brazil and Carlos Chávez of Mexico used folk melodies and rhythms as well as traditional instruments in their works. Alberto Ginastera of Argentina emphasized folk music in his early works but gained international recognition for his later experimental operas.

Dancing has long been important in the lives of Latin Americans. Indians and blacks developed dances to accompany religious worship, to celebrate such events as birth and marriage, and to mourn the dead. European immigrants introduced the folk dances of their native countries into Latin America. Dancing continues to play a major role in the religious ceremonies and community celebrations of many Latin Americans. It is also a highly popular form of recreation. In many countries, national dance companies stage colorful productions of traditional folk dances. One of the most famous companies is the Ballet Folklórico of Mexico, which has performed in many parts of the world.

Most Latin American countries have their own traditional dances. Many of these dances include steps from Spanish or Portuguese folk dances. For example, the Spanish *zapateado* (heel-beating steps) are part of the *cueca* of Bolivia and Chile; the *joropo* of Venezuela; and the *jarabe tapatío*, or *Mexican hat dance*, of Mexico. In the West Indies, African and Spanish influences were combined in such ballroom dances as the *rumba* and *cha-cha*. The rumba, cha-cha, and some other Latin American dances, including the Argentine *tango*, Brazilian *samba*, and Cuban *conga*, are popular outside Latin America.

Handicrafts. Many handcrafted items made by Latin Americans combine artistic beauty with practical use. This type of art is called *artes populares* (popular arts) and is part of daily life in much of Latin America. Superb craftwork can be found in tools and household items as well as in ornaments and religious objects. Latin Americans have long been famous for their excellent glassware, metalwork, pottery, and textiles.

Most handicrafts are inexpensive. Many craftworkers produce these items in their homes using local materials. For example, Indians of the Andes Mountains weave wool from such animals as alpacas and llamas into beautifully designed ponchos and sweaters. In the West Indies, people make dishes for baking seafood from sea shells and carve coconut shells into serving dishes. In the tropical lowlands of Central America, people make lightweight chairs from sturdy plant fibers.

Many handcrafted items are decorated with such folk art figures as chickens, dogs, and frogs or with Indian religious symbols. The *eye of god*, an Indian religious symbol, is a popular wall decoration. It consists of colored threads woven in a special pattern around crossed sticks.



Odyssey Productions

Handicrafts are practiced widely in Latin America. The Indians are especially famous for their metalwork, pottery, and textiles. This Zapotec Indian of Mexico is weaving brightly colored cloth.

History

This section traces the broad outlines of Latin American history. For the history of a particular country, see the *World Book* article on that country. See also the articles listed under "Biographies" and "History" in the *Related articles* at the end of this article.

The first inhabitants of Latin America were American Indians. Most scientists believe that the ancestors of these Indians came to North America from Asia about 15,000 years ago. At that time, a land bridge connected Asia and North America where the Bering Strait now divides Siberia and Alaska. The people from Asia probably crossed the land bridge, following animals they hunted. Their descendants became known as Indians. By 12,500 years ago, Indians had spread throughout much of the Americas to the southern tip of South America.

For thousands of years, the Indians lived in small groups. They traveled continuously in search of animals and wild plants for food. Eventually, some Indians began to farm the land. The Indians were the first people to grow cacao, corn, kidney and lima beans, peanuts, potatoes, squash, tobacco, and tomatoes. Indians who farmed could remain in one place and produce enough food for many others. They built permanent houses and settled in small villages. As the Indian population increased, some villages grew into towns and cities, and several advanced civilizations developed.

The earliest Indian civilization in the Americas was probably that of the Olmec. The Olmec civilization thrived in what is now eastern Mexico from about 1200 to 400 B.C. The Maya civilization of southern Mexico and northern Central America reached its peak between about A.D. 250 and 900. The Maya produced magnificent architecture, painting, pottery, and sculpture. They developed a calendar and an advanced system of writing. The Maya had great knowledge of astronomy, which helped them predict growing seasons. They also built a vast system of underground irrigation canals.

The Toltec controlled central Mexico from about 900 to 1200. By the early 1400's, the Aztec had replaced the Toltec as the most powerful people in the region. The Aztec civilization flourished until the early 1500's. Both the Toltec and the Aztec constructed gigantic pyramids and other structures, many of which still survive. The Inca ruled a huge empire along the west coast of South America during the 1400's and early 1500's. The Inca were superb architects and farmers. They built an extensive system of roads through the Andes Mountains to connect the distant cities of their empire. Inca farmers cut terraces into steep hillsides and brought water to these plots through irrigation canals.

European discovery and exploration. In 1492, Christopher Columbus, an Italian navigator who was in the service of Spain, became the first European to reach Latin America. Columbus sailed west from Spain in hope of finding a short sea route to eastern Asia. He landed on the island of San Salvador in the West Indies and believed that he had reached Asia.

After Columbus returned to Spain, news of his discovery created great excitement in Europe. To prevent disputes between Portugal and Spain over which country could claim the newly discovered lands, Pope Alexander VI drew the Line of Demarcation in 1493. This imaginary north-south line lay about 350 miles (563 kilometers) west of two island groups in the North Atlantic

Important dates in Latin America

c. 6000 B.C. Indians had spread throughout much of the Americas to the southern tip of South America.

A.D. 250-900 The civilization of the Maya Indians, located in southern Mexico and northern Central America, reached its peak.

1400's-early 1500's The Aztec in Mexico and the Inca in western South America controlled large empires.

1492 Christopher Columbus became the first European to reach Latin America.

1494 Spain and Portugal agreed to the Line of Demarcation, which fixed their areas of rule in Latin America.

Early 1500's Spanish troops conquered most of Latin America's Indian civilizations.

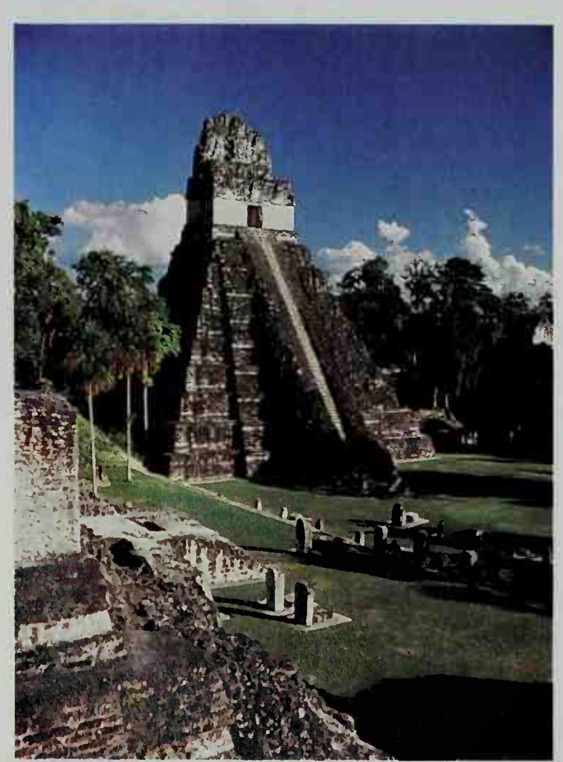
Early 1800's Most Latin American colonies gained independence.

Late 1800's Cooperation between Latin American countries and the United States, called *Pan-Americanism,* began to grow.

Mid-1900's Violence erupted in many Latin American countries as rival political groups struggled for power.

1959 Fidel Castro established a Communist state in Cuba.

1980's Several Latin American countries regained civilian rule after a period of military rule.



Odyssey Productions

Maya ruins include the Temple of the Giant Jaguar, *above,* in Guatemala. The Maya civilization reached its height in Mexico and Guatemala between about A.D. 250 and 900.

Ocean—the Azores and the Cape Verde Islands. All lands west of the line belonged to Spain, and all lands to the east belonged to Portugal. However, the Portuguese soon became dissatisfied because they thought the line gave Spain too much territory. In 1494, Portugal and Spain signed the Treaty of Tordesillas, which moved the line about 1,295 miles (2,084 kilometers) west. As a result, Portugal gained the right to settle the eastern section of what is now Brazil. Portugal took possession of this area in 1500, when a Portuguese navigator named Pedro Álvares Cabral landed on the east coast of Brazil.

Columbus made four voyages to Latin America between 1492 and 1502. During these voyages, he explored many islands in the West Indies and the coasts of what are now Honduras, Costa Rica, Nicaragua, Panama, and Venezuela. Other explorers soon followed Columbus to Latin America. The Europeans quickly realized that the region was not Asia but a new land. Mapmakers named the land *America* in honor of the Italian-born explorer Amerigo Vespucci. Vespucci made several voyages to Latin America in the late 1490's and early 1500's for Spain and Portugal. Vespucci was one of the first ex-





Granger Collection

The Spanish conquest of the Aztec Indians of Mexico was completed in 1521. This drawing by an Aztec artist shows the Spanish and their Indian allies battling Aztec warriors.

plorers to state that the region was a "New World."

In 1513, the Spanish adventurer Vasco Núñez de Balboa crossed Panama and became the first European to see the eastern shore of the Pacific Ocean. His discovery provided additional proof that America was a separate continent between Europe and Asia. In 1520, the Portuguese navigator Ferdinand Magellan became the first European to discover the waterway that connects the Atlantic Ocean and the Pacific Ocean at the southern tip of South America. Magellan sailed down the east coast of South America and through the strait that now bears his name.

The conquest of the Indians began soon after the Europeans arrived in Latin America. By the mid-1500's, a small group of Spanish adventurers known as *conquistadors* (conquerors) had defeated the great Indian civilizations and given Spain a secure hold on most of Latin America. The conquistadors led relatively small but well-equipped forces. They easily defeated large armies of Indians, who had never seen guns or horses.

The first major conquests of the Indians occurred in Mexico and Central America. The conquistador Hernando Cortés landed in Mexico in 1519. By 1521, he had conquered the great Aztec empire. The following year, another conquistador, known as Pedrarias, conquered the Indians of what are now Costa Rica and Nicaragua. In 1523, Pedro de Alvarado, one of Cortés's officers, conquered what are now El Salvador and Guatemala. These conquistadors, together with Balboa in Panama, secured Central America for Spain.

In 1531, the conquistador Francisco Pizarro sailed south from Panama to what is now Peru. During the next two years, his army marched about 3,000 miles (4,800 kilometers) through the Andes Mountains and conquered the huge Inca empire. Pizarro founded Lima in 1535. The city became Peru's capital and the center of Spanish government in South America. One of the few areas the Spanish failed to conquer was southern Chile, where the Araucanian Indians resisted for more than 300 years.

Colonial rule. Even before the military conquest of Latin America was complete, Spanish and Portuguese settlers began pouring into the region. Many of them came in search of adventure and mineral wealth. Others established plantations to grow sugar cane, tobacco, and other crops to export to Europe. Much of Latin America was colonized by the time the first European settlers arrived on the Atlantic coast of North America in the mid-1500's. During the 1600's, the Dutch, English, and French established small colonies in Latin America, chiefly in the West Indies.

Large numbers of Latin American Indians died of diseases brought by Europeans or were killed in warfare. During the early 1500's, Spain established the *encomienda* system in Latin America. Under this system, the Spanish king granted colonists the right to collect tribute from Indians living on certain large tracts of land. The colonists forced the Indians to farm the land or work in mines. In return, the colonists were supposed to protect the Indians and convert them to Christianity. However, many colonists treated the Indians cruelly. Several Roman Catholic missionaries, especially Bartolomé de Las Casas, pleaded for more humane treatment of the Indians. But millions of Indians died from overwork and harsh treatment. As the Indian population of Latin America declined, Europeans began to import black Africans as slaves (see **Slavery**).

Power in colonial Latin America rested with three groups. One group consisted of government officials appointed by European rulers. In each colony, these officials controlled a highly centralized government. This type of administration, in which a few individuals held power, enabled the Europeans to govern the colonies for one main purpose—to exploit their natural resources to the fullest.

The Roman Catholic clergy was another power group. The clergy controlled education in the colonies and was charged with converting the Indians and blacks to Christianity.

The third power group in colonial Latin America consisted of landowners and mine operators. Many settlements in Latin America sprang up near choice farmland or important mineral resources. As a result, numerous communities lay far from the centers of colonial government. In many such cases, the local landowners or mine operators held economic and political control. Some owners and operators used their power justly, but others were ruthless dictators.

Europe profited tremendously from Latin America's mineral wealth and agricultural products. Ships filled with silver and gold regularly departed from Latin American ports for Europe. Agricultural exports included coffee, cotton, sugar cane, and tobacco. Over the years, Spain's economy became increasingly dependent on Latin America. The country suffered hardship if vessels from the colonies carrying valuable cargo were sunk in Atlantic storms or raided by pirates.

The beginnings of colonial unrest. Colonial rule of Latin America lasted about 300 years. During that time,

discontent among the colonists gradually grew. Many Latin Americans wanted greater control over their economic and political affairs. But the European powers ignored the demands for more self-government until the movement for independence was unstoppable.

The desire for independence among Latin Americans arose for several reasons. The *criollos* (people of Spanish ancestry born in Latin America) resented the fact that officials from Spain held all the top posts in colonial government. These officials looked down on the criollos because they had not been born in Europe.

Dissatisfaction was even greater among Latin Americans of mixed European and Indian ancestry. Many of these *mestizos* had gained wealth and property and wanted to take an active role in colonial government. However, mestizos had little social or political standing among the Europeans who controlled Latin America.

The continual flow of the region's resources to Europe also angered many Latin Americans. Spain and Portugal permitted the colonies to trade only with their mother countries. The colonies could not even trade among themselves. In addition, Spain and Portugal hampered Latin America's economic growth by discouraging the development of manufacturing. The colonial rulers wanted Latin Americans to buy European-made products rather than manufacture products for themselves.

The political and economic injustices suffered by the colonists led to a growing desire for independence in Latin America. Although Spain and Portugal introduced a number of reforms in the colonies before 1800, many Latin Americans still wanted freedom.



In 1790, after about 300 years of colonial rule, five European countries controlled all of Latin America. From then on, revolutions in Latin America weakened European power in the region.

The wars of independence in Latin America were finally triggered by events in North America and Europe. The success of the Revolutionary War in America (1775-1783) and the ideals of freedom and equality promised by the French Revolution (1789-1799) inspired the unhappy colonists. At the same time, Spain and Portugal were losing their importance as world powers. In 1807, the forces of Napoleon Bonaparte of France invaded and conquered Portugal. The next year, Napoleon drove Ferdinand VII from the Spanish throne and replaced him with his own brother, Joseph Bonaparte. Spain's control over its colonies was thereby weakened, and many Latin Americans took the opportunity to fight for independence.

Mexico began its revolt against Spain in 1810. The struggle was first led by two Roman Catholic priests, Miguel Hidalgo y Costilla and José Mariá Morelos y Pavón. The initial revolt failed, however, and Spanish troops executed both Hidalgo and Morelos. Mexico did not win its independence until 1821.

Central America also gained its freedom from Spain in 1821. Central America had little economic importance, and so Spain largely ignored the area. As a result, Central Americans won their independence without bloodshed. In 1822, Costa Rica, El Salvador, Guatemala, Honduras, and Nicaragua became part of Mexico. In 1823, however, they broke away from Mexico and formed a political union called the United Provinces of Central America. Bitter regional rivalries caused this union to begin to collapse in 1838, and each of the states had become an independent republic by 1841. The territory of Panama was a Colombian province from 1821 until 1903, when it rebelled against Colombia with help from the United States and became an independent country. Belize was a British colony from 1862 to 1981, when it gained independence.

Spanish South America. The two greatest heroes in the fight for independence in Spanish South America were the Venezuelan general Simón Bolívar and the Argentine general José de San Martín. Bolívar helped win freedom for Bolivia, Colombia, Ecuador, Peru, and Venezuela. San Martín fought for the independence of Argentina, Chile, and Peru.

The Venezuelan revolutionist Francisco de Miranda led an unsuccessful revolt against the Spanish in 1806. Bolívar, who had been a follower of Miranda's, launched a new campaign in 1813. His armies fought against the Spanish forces for about 10 years before winning a final, great victory at Ayacucho, Peru, in 1824. The victory assured independence for the Spanish colonies in northern South America.

In the south, landowners in Chile declared their country's freedom in 1810. However, Spanish forces overcame them. Lasting independence was won for Chile in 1818 by armies led by San Martín and the Chilean hero Bernardo O'Higgins. Earlier, in 1816, San Martín had freed Argentina from Spanish rule. His armies later fought for Peru's independence.

Brazil won its freedom from Portugal without firing a shot. When Napoleon invaded Portugal in 1807, the Portuguese ruler, Prince John, fled to Brazil. John returned to Portugal 14 years later, after Napoleon's defeat. He left



Battle of Junin (1900), an oil painting on canvas by Martin Tovar y Tovar (Angelo Hurtado, Museum of Modern Art of Latin America)

Simón Bolívar, a Venezuelan general, helped several Latin American colonies win their independence from Spain. This painting shows Bolívar leading his troops in a battle for Peru's freedom.

his son Pedro to govern Brazil. But the Brazilians no longer wanted to be ruled by Europeans. They demanded freedom from Portugal. In 1822, Pedro declared Brazil an independent empire and took the throne as Emperor Pedro I.

The West Indies. In 1791, Toussaint L'Ouverture and others led black African slaves in Haiti in a revolt against their French rulers. Haiti won its freedom in 1804 and became the first independent nation in Latin America. The Dominican Republic declared its independence in 1844. A revolt broke out against Spanish rule in Cuba in 1895. The United States sided with the Cuban rebels, which led to the Spanish-American War (1898) between Spain and the United States. The United States won the war, and Cuba became a republic in 1902. Under the terms of the peace treaty, Spain also gave up its colony of Puerto Rico to the United States. Most small West Indian islands remained under British, Dutch, or French control until the mid-1900's. Since then, most of these islands have become independent. Many of the others have gained more control over their affairs.

The problems of independence. During colonial times, Latin Americans were governed by the laws of distant monarchs and had almost no voice in their own affairs. When they rebelled and established their own countries, they thus had little experience in government. For that reason, some leaders thought it unwise to establish republics in Latin America. But eager patriots, inspired by the French Revolution and the Revolutionary War in America, demanded republican government.

After achieving independence, Latin Americans soon found that it was easier to set up a republican government than to make it work. The inexperience of the new leaders led to violent struggles throughout Latin America. Ambitious dictators seized power in a number of countries. Armies that had fought for independence often helped keep dictators in power. In other countries, wealthy landowners controlled the government.

Immediately upon gaining independence, many Latin American republics abolished slavery. By the late 1800's, all the slaves in the region had been freed. However, independence brought little improvement in the lives of most Latin Americans. Wealthy criollos and mestizos took over the established economic, political, and social institutions. Poor mestizos, Indians, and blacks had little, if any, power. For many of these people, life became even harder than it had been under colonial rule.

Border disputes. Since independence, relations between a number of Latin American countries have been severely damaged by disagreements over national boundaries. War broke out in 1825 between Argentina and Brazil over disputed territory bordering both countries. A treaty signed three years later established the area as the independent nation of Uruguay. In the War of the Triple Alliance (1865-1870), Argentina, Brazil, and Uruguay defeated Paraguay. The war firmly established the common borders of those countries. About half of Paraguay's population was killed in the conflict. In the War of the Pacific (1879-1883), Chile fought Bolivia and Peru over a nitrate-rich area along the Pacific Ocean. Chile won the war and took possession of the territory, leaving Bolivia without a seacoast. Bolivia has remained landlocked ever since.

From 1932 to 1935, Bolivia and Paraguay fought for control of the Gran Chaco, a lowland region bordering both countries. Most of the area was eventually awarded to Paraguay. Fighting broke out several times during the early 1900's between Peru and Ecuador over a wild, uncharted area of the Amazon River Basin between Ecuador and Brazil. Peru annexed the area in the 1940's. However, Ecuador still claimed the area, and fighting between Ecuador and Peru broke out there from time to time. Finally, in 1998, the two countries signed a treaty that established their border and ended the dispute. Some disagreements continue. Guatemala claims land controlled by Belize, and Venezuela declares ownership of about two-thirds of Guyana.

Trade relations and economic developments. Since colonial days, the economies of many Latin American countries have depended heavily on the export of a

few agricultural and mineral products. The exports of some nations consist chiefly of one product—for example, bananas in Honduras; coffee in Colombia; copper in Chile; petroleum in Ecuador, Mexico, and Venezuela; sugar in Cuba and the Dominican Republic; and tin in Bolivia. A drop in the market price for these exports causes severe economic hardships. Since the mid-1900's, many countries have spent large sums of money to develop other industries and so lessen their dependence on agricultural and mineral exports. Many of these countries have received loans from regional and international economic organizations for this purpose. They have also been given economic aid from other nations.

In the past, most Latin American nations imported many manufactured goods from Europe and the United States. Latin American countries traded relatively little with one another because they produced similar products. With the growth of manufacturing, however, several economic unions were formed to encourage regional trade. They included the Latin American Integration Association, the Central American Common Market, the Caribbean Community and Common Market, and the Andean Pact. These organizations worked to lower trade barriers among the member countries and to promote economic growth in the region.

Before the 1960's, most major industries in Latin America were owned by United States and European companies. Many Latin Americans believed that these foreign businesses were only interested in making huge profits and cared little for the welfare of the region's people. In the late 1960's, some countries passed laws prohibiting foreign ownership of certain key industries. The governments of such nations as Bolivia, Guyana, Peru, and Venezuela took control of industries previously owned by U.S. and European companies. However, most countries also encouraged foreign investment in industries that require modernization.

Since the 1980's, many important changes have taken place in the economies of Latin American countries and in Latin American patterns of trade. Although some countries still export only a few agricultural and mineral products, Brazil and certain other countries in the region have become important exporters of manufactured goods. Latin American countries have added new agricultural products, such as cut flowers, to the ranks of their exports, and they have tapped new overseas markets.

The movement to establish unity among the nations of North and South America, called *Pan-Americanism,* dates from the early 1800's. In 1826, the great Venezuelan general Simón Bolívar called the first in a series of conferences of the newly independent Latin American countries. He believed the republics needed to work together to solve common problems. But for over 60 years, national jealousies kept the republics from achieving regional cooperation.

In 1890, the United States and 18 Latin American nations formed the International Union of American Republics. The central office of this organization, called the Commercial Bureau of the American Republics, was renamed the Pan American Union in 1910. The purpose of the Pan American Union was to establish closer economic, cultural, and political cooperation among member nations. The Organization of American States (OAS) was established in 1948, and the Pan American Union became its permanent governing body. The membership of the OAS consists of the United States and all the independent countries of Latin America. The OAS seeks to provide for collective self-defense, regional cooperation, and the peaceful settlement of disputes.

In 1947, the United States and nearly all the Latin American republics signed the Inter-American Treaty of Reciprocal Assistance. The treaty was drawn up near Rio de Janeiro, Brazil, and is commonly called the Rio Treaty. It states that an armed attack against any country that signed the treaty would be considered an attack against all the other countries.

Latin America and the United States have often had a difficult relationship. The United States supported the Latin American colonies in their wars of independence. In 1823, U.S. President James Monroe issued the Monroe Doctrine, which warned European powers not to meddle in the affairs of the Western Hemisphere. But the doctrine caused much resentment among Latin Americans. Many of them felt that the United States was assuming its superiority over Latin America by making itself the region's protector.

Numerous Latin Americans distrust the United States because of its great wealth and power. At times, they have suspected it of trying to control the entire hemisphere. Such suspicions arose when the United States fought the Mexican War (1846-1848) after annexing Texas in 1845. Latin Americans were also concerned when the United States won control of Puerto Rico in 1898 as a result of the Spanish-American War.

The presence of United States military forces in Latin America increased during the early 1900's. In 1903, U.S. troops helped Panama win its independence from Colombia. In return, Panama gave the United States permanent control of the zone where the Panama Canal was later built. Latin Americans were especially upset when the United States stationed marines in Nicaragua from 1912 to 1933, in Haiti from 1915 to 1934, and in the Dominican Republic from 1916 to 1924. The marines were sent to these countries to protect U.S. interests during times of political unrest. Several Latin American countries sided with the United States against Germany during World War I (1914-1918), but most remained neutral.

Latin American distrust of the United States decreased somewhat after a Pan-American conference in 1933. All the nations pledged themselves to the Good Neighbor Policy outlined by U.S. President Franklin D. Roosevelt. The policy provided that no nation would interfere in the affairs of any other nation. During World War II (1939-1945), all the Latin American nations supported the Allies, though only Brazil and Mexico provided troops.

Since the mid-1900's, the United States has sent billions of dollars and many technical experts to help Latin American countries solve their social and economic problems. Such aid programs as the Alliance for Progress and the Peace Corps have helped improve Latin American agriculture, industry, educational systems, and health services.

Relations between Latin America and the United



Karl Schumacher, The White House

U.S. President Jimmy Carter, *left,* at a 1977 ceremony, signed a treaty that gave Panama complete control of the Panama Canal beginning on Dec. 31, 1999.

States showed signs of strain during the 1970's and early 1980's. The United States cut back its aid to some Latin American governments that had violated the civil rights of their citizens. For their part, many Latin Americans saw hidden motives in U.S. actions, even aid programs. They opposed U.S. influence in their affairs and demanded greater independence from the United States. On the other hand, the rulers of some nations have asked the United States for additional economic and military aid because of the rise in violence among their citizens demanding reforms.

The United States took several steps to relieve tensions in the area. In 1977, for example, the United States and Panama signed a treaty that gave Panama total control of the Panama Canal on Dec. 31, 1999.

Political unrest. During the early and mid-1900's, widespread protests broke out in many Latin American countries as the people demanded major economic and political reforms. Revolutions overthrew a number of dictators. However, the end of dictatorship did not bring about stability or more representative government in many of the countries.



United Press Int.

Fidel Castro waves to crowds in Havana, Cuba, in 1959 after leading a successful revolution against the dictator Fulgencio Batista. Under Castro, Cuba became a Communist dictatorship.

During the mid-1900's, violence frequently erupted as rival political groups struggled for power. Bombings, kidnappings, and assassinations occurred in numerous countries. Military leaders took control of several Latin American governments. These leaders often violated the people's civil rights, claiming such violations were necessary to achieve stability and reforms. They closed universities, shut down newspapers, established strict censorship laws, and jailed thousands of people without trial as suspected terrorists.

One of the most significant political developments in Latin America occurred in 1959. That year, Fidel Castro led a revolution in Cuba that overthrew the military dictatorship of Fulgencio Batista. Castro established a Communist dictatorship. He pledged to help Communist rebels in other Latin American countries gain power.

After the Castro revolution, activity by Communist and other leftist organizations increased greatly in Latin America. In response to such Communist activity, the United States increased the amount of military and economic aid that it gives to several Latin American countries.

Recent developments. Latin America's economy grew rapidly during the 1960's and 1970's but slowed dramatically in the 1980's. Many countries had borrowed huge sums of money at high interest rates to finance their industrial development and were not able to repay their loans. The resulting economic instability—along with continued civil rights violations—led to widespread protests in the 1980's against military governments. Eventually, civilian governments elected by the people replaced the military governments in such countries as Argentina, Brazil, and Chile.

The establishment of these new democracies together with the breakup of the Soviet Union and the end of the Cold War led to a new phase in relations between the United States and the nations of Latin America in the 1990's. Previously, the United States had been concerned with the Castro revolution and the possible spread of Communism to Latin American countries. But with the end of the Cold War, the United States became concerned with economic issues in Latin America and the preservation of the fragile new democracies in the region.

Today, Latin American countries face serious social and economic problems that they are attempting to solve by modernizing their economies and expanding trade. But many experts doubt that these efforts alone will be able to solve the region's problems. The gap between rich and poor continues to widen, millions continue to live in miserable poverty, and the population is still growing at a rapid rate. Steve C. Ropp

Study aids

Related articles in World Book include:

Biographies

Alvarado, Pedro de

Balboa, Vasco Núñez de

Bolívar, Simón
Cabral, Pedro Álvares
Columbus, Christopher
Cortés, Hernando
Hidalgo y Costilla, Miguel
Magellan, Ferdinand
Miranda, Francisco de
O'Higgins, Bernardo
Pedro I
Pedro II
Pizarro, Francisco
San Martín, José de
Toussaint L'Ouverture
Vespucci, Amerigo

Countries and other political units

See the separate articles on Latin American countries and other political units listed in the *table* with this article. See also the following articles:

Central America
North America
South America
West Indies

History

Alliance for Progress
Aztec
Exploration
Guantánamo
Inca
Line of Demarcation
Maya
Monroe Doctrine
Olmec Indians
Organization of American States
Palmares
Pan-American Conferences
Panama Canal (History)
Roosevelt, Franklin D. (Good Neighbor Policy)
Roosevelt, Theodore (Foreign policy)
Spanish-American War
Toltec Indians

Other related articles

Bank (Latin America)
Bullfighting
Christmas (In Latin America)
Clothing (pictures)
Common market
Flag (picture: Historical flags of the world)
Gaucho
Indian, American
Latin-American literature
Liberation theology
Mercosur
Pan American Highway
Sculpture (Indian sculpture of the Americas)
Television (In Latin America)
Third World

Outline

I. People
A. Population
B. Ancestry
C. Languages

II. Way of life
A. City life
B. Rural life
C. Family life
D. Clothing
E. Food and drink
F. Recreation
G. Religion
H. Education

III. The arts
A. Architecture
B. Literature
C. Painting
D. Sculpture
E. Music
F. Dancing
G. Handicrafts

IV. History

Questions

How do city and country life differ in Latin America?
What are *mestizos*? *Mulattoes*?
How does the Roman Catholic Church influence the daily lives of Latin Americans in some countries?
What was the Line of Demarcation?
Why do many Latin American children fail to complete elementary school?
Why did the Indian population decline after European colonists arrived in Latin America?
What are *artes populares*?
Why have millions of rural Latin Americans moved to urban areas?
What were the main reasons Latin American colonists wanted independence from their European rulers?
Why do numerous Latin Americans distrust the United States?

Additional resources

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Latin-American literature consists of the literature of the Spanish-speaking countries of the Western Hemisphere, of Puerto Rico, and of Portuguese-speaking Brazil. For the historical background of the literature, see **Latin America.**

Colonial literature

The colonial period began with the first Spanish and Portuguese explorations of the New World in the late 1400's. It ended with the colonial wars for independence more than 300 years later. The earliest colonial literature consisted mostly of chronicles and narratives written by soldiers and missionaries who described their amazing encounters with new landscapes and civilizations. The authors mixed fantasy with realism in describing their adventures and contacts with unfamiliar peoples, customs, animals, and plants.

Hernando Cortés, the Spanish conqueror of the Aztec empire, wrote five reports for King Charles I of Spain. These accounts, known as the *Five Letters* (1519-1526), are a gripping and detailed presentation of Cortés's campaign. Bernal Díaz del Castillo, who served in the Aztec campaigns led by Cortés, wrote a lively chronicle, *The True History of the Conquest of New Spain* (1522).

Many works dealt with the period of conquest. In *The Devastation of the Indies: A Brief Account* (1552), the Dominican missionary Bartolomé de Las Casas criticized the brutal treatment of the Indians by the Europeans. The *Royal Commentaries* (1609) of Garcilaso de la Vega, who was known as El Inca, dramatizes the history of the Inca empire.

The greatest poem of the time was *La Araucana* (1569-1589) by Alonso de Ercilla y Zúñiga. The poem told of the bravery of Chilean Indians who resisted the Spanish invaders. The first colonial poet to write in Portuguese was Bento Texeira Pinto. In his epic *Prosopopéia* (1601), he dealt with the individual and nature in the American environment.

A new literary style called the *baroque* emerged during the second half of the 1600's. Baroque authors wrote in an ornate and artificial style and used cutting wit and intricate wordplay. The complex baroque style pro-

duced works that were often difficult to understand.

The leading writer of the baroque period was the Mexican nun Sor Juana Ines de la Cruz, who is generally considered the finest writer in colonial Latin-American literature. She wrote plays, satires, philosophical works, and various types of poetry.

Juan del Valle y Caviedes of Peru composed satirical poetry that criticized the corruption he saw in colonial society. Gregório de Matos of Brazil also wrote satirical poetry. The Brazilian poet Tomás Antônio Gonzaga wrote some of the finest lyric poetry in the Portuguese language, notably his love poem *Marília de Dirceu* (1792). The Brazilian writers José Basílio da Gama and José de Santa Rita de Durão continued the tradition of epic poetry. Da Gama's *Uruguay* (1769) describes the war between the European conquerors and the Paraguayan Indians. De Durão's *Caramurú* (1781) narrates the discovery and settlement of Brazil.

The 1800's

Most of the Latin-American colonies began fighting for their independence from Spain and Portugal in the early 1800's. Hostility toward the colonial powers led to the so-called Wars of Independence, which began in 1810 and lasted for about 16 years. The wars inspired writers to compose patriotic poetry and fiction that satirized the colonial powers. José Joaquín Fernández de Lizardi wrote perhaps the first Latin-American novel, *The Itching Parrot* (1816), a satirical story about the corrupt colonial society of Mexico City. José Joaquín Olmedo of Ecuador wrote the famous patriotic poem "Song to Bolívar" (1825).

Romanticism was a cultural movement that began in Europe in the late 1700's and spread to Latin America. Romanticism emphasized individualism and nationalism. It also stressed artistic freedom to pursue new subject matter and fresh literary forms.

José María Heredia of Cuba was one of Latin America's earliest romantic writers. He wrote the melancholy nature poem "On the Pyramid of Cholula" (1820). Some of the poetry of Andrés Bello of Venezuela has subtle romantic elements, especially "Ode to the Agriculture of the Torrid Zone" (1826).

A type of romanticism called *nativism* developed in the 1800's. Nativist writers dealt with the distinctive regional characteristics of their countries. Esteban Echeverría of Argentina expressed his love of the vast Argentine *Pampas* (plains) in his lyric poetry. Gaucho literature became especially popular. Gauchos were nomadic cowboys who were depicted as romantic outlaws. José Hernández of Argentina wrote the best-known example of gaucho literature, the epic poem *Martín Fierro* (1872, 1879). This work recounts the gaucho hero's lonely life, his encounters with Indians, and the harsh treatment he receives from an insensitive government.

The novel flourished during the romantic period. Jorge Isaacs of Colombia wrote *María* (1867), a sentimental love story that remains one of the most popular works in Latin-American literature. José Marmol of Argentina and Ignacio Manuel Altamirano of Mexico were liberal writers who wrote novels that opposed political injustice. Another political writer, Domingo Faustino Sarmiento of Argentina, mixed essays and fiction in *Civilization and Barbarism: Life of Juan Facundo Quiroga* (1845).

The romantic concept of the *noble savage* became a popular theme during the 1800's. To the romantics, non-Europeans such as the Indians were superior because they were not corrupted by European civilization. In Brazil, the poetry of Antônio Gonçalves Dias won praise for its glorified portrayal of the Indians. Indians were the heroes of the novels *O Guarani* (1857) by José de Alencar of Brazil and *Cumandá* (1879) by Juan León Mera of Ecuador and of the epic poem *Tabaré* (1888) by Juan Zorrilla de San Martín of Uruguay.

The Peruvian writer Ricardo Palma created a unique literary form called *tradición*. The form consisted of prose sketches that combined history, legend, gossip, stories, and humor. Palma's sketches were collected in *Peruvian Traditions,* published from 1872 to 1910.

Realism was a literary movement that developed in the late 1800's. Writers tried to capture external reality in a detailed and objective way. Their works showed how human beings are influenced by their social environment. Some writers wrote in a more severe and pessimistic form of realism called *naturalism*.

The leading Latin-American realists included the novelists Alberto Blest Gana and Baldomero Lillo of Chile, Clorinda Matto de Turner of Peru, Eugenio Cambaceres of Argentina, and Federico Gamboa of Mexico. Probably the most important realist was the Brazilian novelist Joaquim Maria Machado de Assis. His best-known novels, *Epitaph of a Small Winner* (1881) and *Dom Casmurro* (1900), show a mastery of characterization and narrative technique.

A number of writers emphasized the local customs, habits, and speech of Spanish America's regions in sketches, short stories, and novels. Their works became known as *costumbrismo*. The leading costumbrista authors included Javier de Viana of Uruguay, Roberto J. Payró of Argentina, and Tomás Carrasquilla of Colombia. All these writers emphasized descriptions of local rural landscapes and types in their stories. The best-known realist playwright was Florencio Sánchez of Argentina, who wrote plays dealing with human conflict in rural Argentina.

Modernism, which lasted from about 1888 to 1910, was one of the most significant literary periods in Latin-American literature. The most important writers were poets. The Nicaraguan poet Rubén Darío gave modernism its form. Darío believed that poetry should avoid messages. Instead, poetry should strive to attain beauty in its purest form while liberating verse from traditional styles. In their search for the unusual, poets turned to such exotic sources as Greek, Oriental, and Nordic mythology. Darío's book of poems called *Azul* (1888) marked the beginning of modernism. Leopoldo Lugones of Argentina was another leading poet of the period.

José Enrique Rodó, a Uruguayan essayist, exerted almost as much influence as Darío. Rodó's essay *Ariel* (1900) became a landmark of Latin-American thought. Rodó appealed to the young people of Latin America to strive for idealism and high spiritual goals, both of which were being threatened by modern materialism. José Martí of Cuba was another influential Latin-American intellectual. He was a celebrated journalist, essay-

ist, and poet who was honored as a patriot after he died fighting for Cuban independence.

The 1900's

The early 1900's. A group of women poets won praise during the early 1900's. Many of their poems dealt with love and womanhood in a society dominated by men. In 1945, Chilean poet Gabriela Mistral became the first Latin American to receive the Nobel Prize for literature. Other leading woman poets included Delmira Agustini and Juana de Ibarbourou of Uruguay and Alfonsina Storni of Argentina.

Novelists took a fresh interest in regional themes. José Eustasio Rivera of Colombia portrayed the Amazon rain forest as a place of beauty and terror in *The Vortex* (1924). Rómulo Gallegos wrote about the tropical plains of Venezuela in *Doña Bárbara* (1929). Ricardo Güiraldes of Argentina told the adventures of a boy who receives spiritual guidance from a gaucho in *Don Segundo Sombra* (1926). José Lins do Rego's "sugarcane cycle" of novels (1932-1943) recaptures the author's childhood on a sugar plantation in Brazil.

Many regional novels explored social and political problems. *Rebellion in the Backlands* (1902) by Euclides da Cunha gives a dramatic picture of a military conflict between poverty-stricken peasants and government forces. The Mexican revolution of 1910 inspired Mariano Azuela's novel *The Underdogs* (1916). Graciliano Ramos's *Barren Lives* (1938) and Jorge Amado's *The Violent Land* (1942) criticized social conditions in Brazil. The mistreatment of Indians is portrayed in *Huasipungo* (1934) by Jorge Icaza of Ecuador, *El indio* (1935) by Gregorio López y Fuentes of Mexico, and *Yawar Fiesta* (1940) by José María Arguedas of Peru.

Several Latin-American poets of the 1920's experimented with form and technique. The most important of these poets were Vicente Huidobro and Pablo Neruda of Chile, César Vallejo of Peru, Mario de Andrade of Brazil, and Jorge Luis Borges of Argentina. They rejected traditional forms to create poetry with unusual imagery. Such poems were intended to reveal the subconscious mind. Andrade's *Hallucinated City* (1922) is an example of the experimental poetry of the time.

The mid-1900's. A variety of themes dominated the literature of the mid-1900's. A sense of isolation and lack of human communication was expressed by Eduardo Mallea of Argentina in his novels *Bay of Silence* (1940) and *All Green Shall Perish* (1941). Ciro Alegría of Peru wrote a novel of social protest about the abuses of Peruvian Indians in *Broad and Alien Is the World* (1941). Jorge Luis Borges wrote philosophical short stories of fantasy in *Ficciones* (1944).

During the mid-1940's, writers combined authentic subject matter, varied themes, and experiments in language to produce the "new novel." Novelists became more aware of their cultural identity, but they avoided extreme expressions in their works. The best-known examples of the "new novel" included *El señor presidente* (1946) by Miguel Angel Asturias of Guatemala, *The Edge of the Storm* (1947) by Augustín Yáñez of Mexico, *Adán Buenosayres* (1948) by Leopoldo Marechal of Argentina, *Born Guilty* (1951) by Manuel Rojas of Chile, *The Lost Steps* (1953) by Alejo Carpentier of Cuba, and *Pedro Páramo* (1955) by Juan Rulfo of Mexico.

The leading Latin-American poet at midcentury was the Mexican Octavio Paz. Much of his verse deals with Mexican identity and history. He also wrote essays on literary criticism, art, and politics.

Recent developments. The most important development in Latin-American literature since the 1950's has been the sudden and unprecedented international attention enjoyed by novelists. The large number of important novels produced by these writers has been called the "boom." The original boom novelists were Carlos Fuentes of Mexico, Julio Cortázar of Argentina, Mario Vargas Llosa of Peru, and Gabriel García Márquez of Colombia. All four use literary invention in their narratives to express their cultural heritage. They experimented with language and structure, often injecting fantasy and fragmenting time and space. The boom produced a style known as "magic realism," which blended dreams and magic with everyday reality.

Carlos Fuentes's major novels provide a panorama of life in modern Mexico. They include *Where the Air Is Clear* (1958) and *The Death of Artemio Cruz* (1962). Cortázar's most influential novel is *Hopscotch* (1963), which experiments with narrative technique and revolts against traditional uses of language. Many critics consider his short stories to be even better than his novels. Fantasy, allegory, and philosophy characterize such story collections as *A Change of Light* (1974). The boom novelist Vargas Llosa writes about modern Peruvian society. His most ambitious work, *The War of the End of the World* (1981), is a historical novel of high adventure based on Euclides da Cunha's *Rebellion in the Backlands.*

The most famous boom novelist is Gabriel García Márquez, who won the 1982 Nobel Prize for literature. His novel *One Hundred Years of Solitude* (1967) ranks as a landmark of Latin-American fiction. The novel contains much historical fact, but the author also includes fantasy, extraordinary characters, bizarre events, suspense, and unusual humor. García Márquez maintained his international reputation with such works as *The Autumn of the Patriarch* (1975) and *The General in His Labyrinth* (1989). Isabel Allende of Chile blended magic realism and history in her novels *The House of the Spirits* (1985) and *Eva Luna* (1987). Dick Gerdes

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Mistral, Gabriela
Neruda, Pablo
Paz, Octavio
Rodó, José Enrique
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Latin language was the principal language of western Europe for hundreds of years. It was the language of the Roman Empire, and Roman soldiers and traders took it wherever they went. Latin, because of its precise expression, was a perfect language for law and government. As used by the Roman poet Virgil and other literary masters, Latin achieved a dignity and tone rarely equaled by any other language.

Latin has not been a spoken language since the end of the Middle Ages in the early 1500's. However, many Latin words helped shape modern scientific and legal terms. For example, the word *gravity* comes from the Latin word *gravis,* meaning *heavy.* The word *verdict* comes from the Latin words *vere,* meaning *truly,* and *dictum,* meaning *spoken.* The Roman Catholic Church still considers Latin its official language, though Mass has been celebrated in the tongue of the local community since the mid-1960's.

Alphabet. The Latin alphabet was borrowed from the Greeks, probably through the Etruscans, an ancient people who lived in Italy. Classical Latin had 23 letters, lacking *j, u,* and *w.* The letter *i* was used for both *i* and *j,* and *v* was used for both *v* and *u.* Today, Latin texts use *j*'s and *u*'s where those sounds are appropriate. The Roman alphabet became the basis of most modern alphabets. See the *World Book* articles on **Alphabet** and on each letter of the English alphabet.

Grammar. Latin is in the Indo-European family of languages and is closely related to Celtic, Germanic, Greek, Sanskrit, and Slavic languages. Like Greek, Latin is highly *inflected*—that is, changes in word endings indicate changes in meaning. For an example of a Latin noun's inflections, see **Case** (Cases in Latin).

Development. Latin was one of several related languages of ancient Italy. Others, such as Oscan and Umbrian, died out as the influence of Latin spread.

In ancient times. Examples of the earliest Latin, which is sometimes called *preliterary Latin,* were preserved in inscriptions and religious texts. During the 200's and 100's B.C., Latin became a highly developed literary language. It reached its highest level of development in the Golden Age of Latin literature, from 106 B.C. to A.D. 14. Works of prose by Julius Caesar and Cicero, and the poetry of Virgil and Horace, set standards of excellence for future writers. See **Latin literature** (The Golden Age).

A *vernacular* (common) form of Latin developed at the same time as literary Latin. It underwent many changes after the Golden Age. Inflections were simplified, and word order became more regular. The different forms of vernacular Latin appear in the comedies of Plautus, who lived about 200 B.C.; the letters of Cicero, who lived from 106 to 43 B.C.; and the *Satyricon* of Petronius, who died in A.D. 66.

The spread of Christianity, plus invasions by Germanic tribes, contributed to the fall of the West Roman Empire in the 300's and 400's. The Christians and the invaders changed Latin further by adding new words and meanings to the language.

During the Middle Ages, the spoken Latin of the late Roman Empire developed into the Romance languages, including French, Italian, Portuguese, Romanian, and Spanish (see **Romance languages**). At this time, a form of literary Latin called *Medieval Latin* was the language of the Christian church and of education. It ranked as an international tongue and was used by scholars in universities and religious schools throughout western Europe. Latin continued to be used by scientists and philosophers into the 1600's. Examples include René Descartes's *Meditations on First Philosophy* (1641) and Sir Isaac Newton's *Principia Mathematica* (1687).

Latin today. Latin has been taught in schools since the Middle Ages, though its popularity declined during the 1900's. American college students of the 1700's and 1800's were required not only to read Latin fluently but also to write original essays and poems in Latin. During the 1900's, most colleges and universities in the United States relaxed or eliminated these requirements. However, many universities in the United Kingdom and other European countries still require Latin.

Many educators believe the study of Latin trains a student to think precisely and to understand grammatical relationships. Students of Latin can derive the meanings of difficult English words based on their knowledge of Latin roots. They also learn to appreciate the ancient Roman civilization as a source of modern culture. In addition, a knowledge of Latin aids students in learning modern languages, especially the Romance languages.

Latin and English. Scholars estimate that about half of all English words in current use are of Latin origin. Some of these words were borrowed directly from Latin. But most were borrowed from Old French, and thus reflect forms and meanings that Latin words had acquired in that language. For example, the English words *loyal* and *legal* both come from the Latin *legalis,* meaning *legal.* But *loyal* was borrowed from Old French, where its meaning was similar to its meaning in English today.

The vast majority of English abstract words are Latin in origin. When we speak of the "power of liberty," the "spirit of independence," or the "virtue of charity," the two important words in each phrase are derived from Latin. Many English scientific terms come from Latin. The title of every rank in the army, from *private* to *general,* has a Latin origin. Some common Latin idioms remain unchanged in English, including such phrases as *persona non grata, ad infinitum,* and *P.S.* (*post scriptum*). The richness and variety of the English language owe much to the contributions of Latin. Frank Nisetich

Latin literature includes the essays, histories, poems, plays, and other writings of the ancient Romans. In many ways, it seems to be a continuation of Greek literature, using many of the same forms. But Latin literature also mirrored the life and history of ancient Rome.

Characteristics of Latin literature

Much Latin writing reflects the Romans' interest in *rhetoric,* the art of speaking and persuading. Public speaking had great importance for educated Romans because most of them wanted successful political careers. When Rome was a republic, effective speaking often determined who would be elected or what bills would pass. After Rome became an empire, the ability to impress and persuade people by the spoken word lost much of its importance. But training in rhetoric continued to flourish and to affect styles of writing. A large part of rhetoric consists of the ability to present a familiar idea in a striking new manner that attracts attention. Latin authors became masters of this art of variety.

Language and form. Latin is a highly *inflected* language, with many grammatical forms for various words. As a result, it can be used with a pithiness and brevity unknown in English. It also lends itself to elaboration, because its tight syntax holds even the longest and most complex sentence together as a logical unit. Latin can be used with striking conciseness, as in the works of Sallust and Tacitus. Or it can have wide, sweeping phrases, as in the works of Livy and the speeches of Cicero.

Latin lacks the rich poetic vocabulary that marks Greek poetry. Some earlier Latin poets tried to make up for this deficiency by creating new compound words, as the Greeks had done. But Roman writers seldom invented words. Except in epic poetry, they tended to use a familiar vocabulary, giving it poetic value by imaginative combinations of words and by rich sound effects. Rome's leading poets had great technical skill in the choice and arrangement of language. They also had an intimate knowledge of the Greek poets, whose themes appear in almost all Roman literature.

Latin moves with impressive dignity in the writings of Lucretius, Cicero, or Virgil. It reflects the seriousness and sense of responsibility that characterized the ruling class of Rome during the great years of the republic. But the Romans could also relax and allow what Horace called the "Italian vinegar" in their systems to pour forth in wit and satire.

Latin in translation. The best Latin literature has been translated into most major languages. Until the 1900's, the majority of educated people in the West knew at least some Latin. Today, fewer people are familiar with the language, but an increasing number enjoy Latin literature through translations.

Some translators *paraphrase*—that is, they try to keep the beauty and spirit of the original work without providing the exact meaning of each phrase. During the 1600's and 1700's, a number of English poets translated much Latin poetry by paraphrasing. Perhaps the outstanding example was John Dryden's English version of the poems of Virgil, published in 1697.

Other translators provide literal translations, trying to imitate exactly the writings of Latin authors. But these translations lose much of the beauty and style that made the originals works of art. The chief value of literal translations lies in helping students read Latin more easily.

Early Latin literature

Formal Latin literature began in 240 B.C., when a Roman audience saw a Latin version of a Greek play. The adaptor was Livius Andronicus, a Greek who had been brought to Rome as a prisoner of war in 272 B.C. Andronicus also translated Homer's Greek epic the *Odyssey* into an old type of Latin verse called *Saturnian.* The first Latin poet to write on a Roman theme was Gnaeus Naevius during the 200's B.C. He composed an epic poem about the first Punic War, in which he had fought. Naevius's dramas were mainly reworkings of Greek originals, but he also created tragedies based on Roman myths and history.

Other epic poets followed Naevius. Quintus Ennius wrote a historical epic, the *Annals* (soon after 200 B.C.), describing Roman history from the founding of Rome to his own time. He adopted Greek dactylic hexameter, which became the standard verse form for Roman epics. He also became famous for his tragic dramas. In this field, his most distinguished successors were Marcus Pacuvius and Lucius Accius. These three writers rarely used episodes from Roman history. Instead, they wrote Latin versions of tragic themes that the Greeks had already handled. But even when they copied the Greeks, they did not translate slavishly. Only fragments of their plays have survived.

We know much more about early Latin comedy, because we have 20 complete plays by Plautus and 6 by Terence. These men modeled their comedies on Greek plays known as New Comedy. But they treated the plots and wording of the originals freely. Plautus scattered songs through his plays and increased the humor with puns and wisecracks, plus comic actions by the actors. Terence's plays were more polite in tone, dealing with domestic situations. His works provided the chief inspiration for French and English comedies of the 1600's, and even for modern American comedy.

The prose of the period is best known through *On Agriculture* (160 B.C.) by Cato the Elder. Cato also wrote the first Latin history of Rome and of other Italian cities. He was the first Roman statesman to put his political speeches in writing as a means of influencing public opinion.

Early Latin literature ended with Gaius Lucilius, who created a new kind of poetry in his 30 books of *Satires* (100's B.C.). He wrote in an easy, conversational tone about books, food, friends, and current events. In the early A.D. 100's, Juvenal perfected the biting form of satire that has influenced many later writers. See **Satire**.

The Golden Age

Latin literature was at its height from 81 B.C. to A.D. 17. This period began with the first known speech of Cicero and ended with the death of Ovid.

The age of Cicero. Cicero was the greatest master of Latin prose. He dominated Latin literature from about 80 B.C. until his death in 43 B.C. Cicero's many writings can be divided into four groups: (1) letters, (2) rhetorical treatises, (3) philosophical works, and (4) orations. His letters provide detailed information about an important period in Roman history and offer a vivid picture of the public and private life among the Roman governing class. Cicero's works on oratory are our most valuable Latin sources for ancient theories on education and rhetoric. His philosophical works were the basis of moral philosophy during the Middle Ages. His speeches inspired many European political leaders and the founders of the United States.

Julius Caesar and Sallust were outstanding historical writers of Cicero's time. Caesar wrote commentaries on the Gallic and civil wars in a straightforward style to justify his actions as a general. Sallust adopted an abrupt, pointed style in his historical works. He wrote brilliant descriptions of people and their motives.

The birth of lyric poetry in Latin occurred during the same period. The short love lyrics of Catullus have never been surpassed in emotional intensity. Catullus also wrote masterful poems that attacked his enemies. In his longer poems, he suggested beautiful images in rich, delicate language.

In contrast, the poet Lucretius interpreted the ideas of the Greek philosopher Epicurus. Lucretius's work *De-*

rerum natura (55 B.C.) contains many majestic passages. It is a triumph of poetic genius over unpoetic matter.

The most learned writer of the period was Varro. He wrote about a remarkable variety of subjects, from religion to poetry. But only his writings on agriculture and the Latin language survive in their complete form.

The Augustan Age. The emperor Augustus took a personal interest in the literary works produced during his years of power from 27 B.C. to A.D. 14. This period is sometimes called the *Golden Age of Latin Literature.* Virgil published his pastoral *Eclogues;* the *Georgics,* perhaps the most beautiful poem ever written about country life; and the *Aeneid,* an epic poem describing the events that led to the creation of Rome. Virgil told how the Trojan hero Aeneas became the ancestor of the Roman people. Virgil also provided divine justification for Roman rule over the world. Although Virgil died before he could put the finishing touches on his poem, it was soon recognized as the greatest work of Latin literature. Critics still agree on this judgment.

Virgil's friend Horace wrote *Epodes, Odes, Satires,* and *Epistles.* The perfection of the *Odes* in content, form, and style has charmed readers for hundreds of years. The *Satires* and *Epistles* discuss ethical and literary problems in an urbane, witty manner. Horace's *Art of Poetry,* probably published as a separate work, greatly influenced later poetic theories. It stated the basic rules of classical writing as the Romans understood and used them. After Virgil died, Horace was Rome's leading poet.

The Latin elegy reached its highest development in the works of Tibullus, Propertius, and Ovid. Most of this poetry is concerned with love. Ovid also wrote the *Fasti,* which describes Roman festivals and their legendary origins. Ovid's greatest work, the *Metamorphoses* weaves various myths into a fast-paced, fascinating story. Ovid was a witty writer who excelled in creating lively and passionate characters. The *Metamorphoses* was the best-known source of Roman mythology throughout the Middle Ages and the Renaissance. It inspired many poets, painters, and composers.

In prose, Livy produced a history of the Roman people in 142 books. Only 35 survive, but they are a major source of information on Rome.

Later Latin literature

The Imperial Period. From the death of Augustus in A.D. 14 until about 200, Roman authors emphasized style and tried new and startling ways of expression. During the reign of Nero from 54 to 68, the Stoic philosopher Seneca wrote a number of dialogues and letters on such moral themes as mercy and generosity. In his *Natural Questions,* Seneca analyzed earthquakes, floods, and storms. Seneca's tragedies greatly influenced the growth of tragic drama in Europe. His nephew Lucan wrote the *Pharsalia* (about 60), an epic poem describing the civil war between Caesar and Pompey. The *Satyricon* (about 60) by Petronius was the first Latin novel. Only fragments of the complete work survive. It describes the adventures of various low-class characters in absurd, extravagant, and dangerous situations, often in the world of petty crime.

Epic poems included the *Argonautica* of Valerius Flaccus, the *Thebaid* of Statius, and the *Punica* of Silius Italicus. At the hands of Martial, the epigram achieved the stinging quality still associated with it. Juvenal brilliantly satirized vice.

The historian Tacitus painted an unforgettably dark picture of the early empire in his *Histories* and *Annals,* both written in the early 100's. His contemporary Suetonius wrote biographies of the 12 Roman rulers from Julius Caesar through Domitian. The letters of Pliny the Younger described Roman life of the period. Quintilian composed the most complete work on ancient education that we possess. Important works from the 100's include the *Attic Nights* of Aulus Gellius, a collection of anecdotes and reports of literary discussions among his friends; and the letters of the orator Fronto to Marcus Aurelius. The most famous work of the period was *Metamorphoses,* also called *The Golden Ass,* by Lucius Apuleius. This novel concerns a young man who is accidentally changed into a donkey. The story is filled with colorful tales of love and witchcraft.

Later periods. Pagan Latin literature showed a final burst of vitality in the late 200's and 400's. Ammianus Marcellinus in history, Symmachus in oratory, and Ausonius and Rutilius in poetry all wrote with great talent. The *Mosella* by Ausonius demonstrated a modernism of feeling that indicates the end of classical literature as such.

At the same time, other men laid the foundations of Christian Latin literature during the 300's and 400's. They included the church fathers Augustine, Jerome, and Ambrose, and the first great Christian poet, Prudentius.

Elaine Fantham

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Augustine, Saint
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Catullus, Gaius Valerius
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Classicism (Rome)
Horace
Jerome, Saint
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Martial
Ovid
Petronius
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Terence
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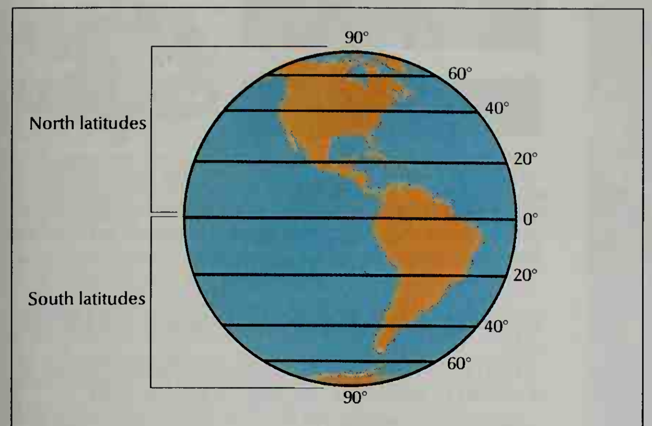
Latinos. See Hispanic Americans.

Latitude, *LAT uh tood,* describes the position of a point on the earth's surface in relation to the equator. Latitude is one of the two grid *coordinates* that can be used to locate any point on the earth. The other coordinate is longitude.

The latitude of a point is measured in terms of its distance from the equator toward one of the earth's poles. Latitude is measured in degrees. Any point on the equator has a latitude of zero degrees (written 0°). The North Pole has a latitude of 90° *north* and the South Pole has a latitude of 90° *south.* These two points are sometimes written +90° and −90°. Degrees of latitude are divided into 60 *minutes* (′), and the minutes each consist of 60 *seconds* (″).

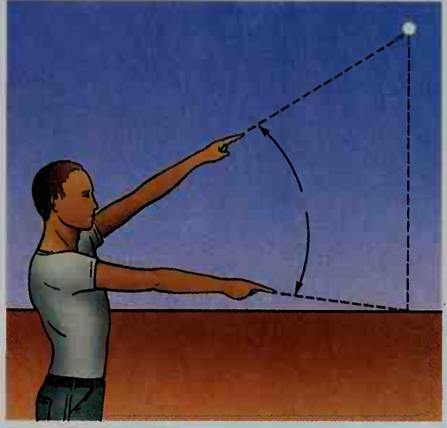
All points on the earth's surface that have the same latitude lie on an imaginary circle called a *parallel of lati-*

Latitude



Imagine a series of lines running around the earth parallel to the equator, *shown here.* These are lines of *latitude.* Every point on the earth's surface lies on such a line. It shows the position of that spot in relation to the equator.

WORLD BOOK illustrations by Sarah Woodward



Point one arm at the North Star and the other at the horizon. The number of degrees of the angle between your arms is about the latitude where you are.

tude. The distance between two parallels that are 1° apart is about 60 *nautical* (sea or air) miles, or 69 *statute* (land) miles or 111 kilometers. This length of 1° of latitude varies from 59.7 nautical miles near the equator to 60.3 nautical miles near the poles. The variation results because the earth is not a perfect sphere. A difference in latitude of 1 minute equals about 1 nautical mile.

Stephen S. Birdsall

See also **Climate** (The role of latitude); **Equator; Longitude; Map.**

Latium, *LAY shee uhm,* was an area in the central part of ancient Italy. It lay in the same general area as the present province of Latium (see **Italy** [political map]). Its chief cities fought the Romans from 340 to 338 B.C. The Romans won, and Latium became part of Roman territory. The people received partial Roman citizenship. The Latin language was named for Latium. Arthur M. Eckstein

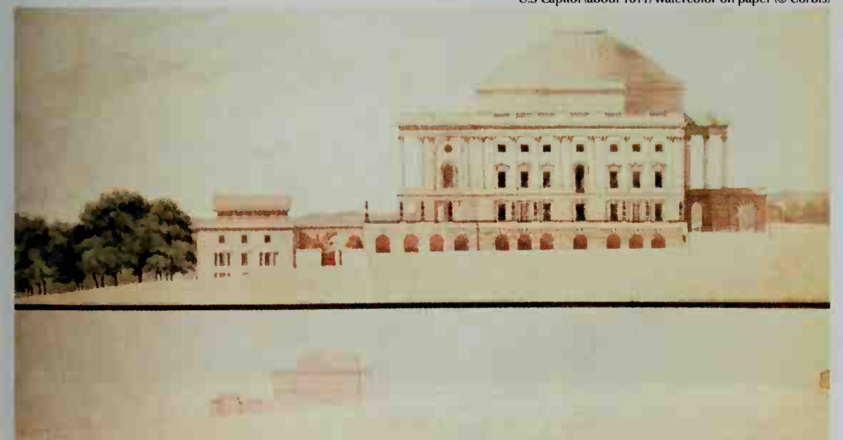
Latrobe, *luh TROHB,* **Benjamin Henry** (1764-1820), was the first important professionally trained architect to practice in the United States. He established the neoclassical style for the new federal government buildings in Washington, D.C. He also introduced the Greek Revival style into the United States. The Bank of Pennsylvania (1800), designed by Latrobe, became the first building in the nation to extensively feature elements of ancient Greek architecture.

Latrobe was born on May 1, 1764, near Leeds, England. He began to practice architecture in England but moved to the United States in 1796. He established his first practice in Richmond, Virginia, where he designed the Richmond Penitentiary (1797). In 1803, President Thomas Jefferson appointed Latrobe surveyor of the public buildings of the United States. From 1803 to 1812, Latrobe worked on the U.S. Capitol in Washington, D.C., and was responsible for much of its design. He also designed the U.S. Customs House (1809) in New Orleans as well as many private houses. He also helped Jefferson with the plans for the University of Virginia. From 1815 to 1817, Latrobe directed the reconstruction of the Capitol and other buildings destroyed during the War of 1812. Latrobe's masterpiece is the Basilica of the Assumption (1821) in Baltimore. Nicholas Adams

Latter Day Saints, Reorganized Church of Jesus Christ of. See Community of Christ.

Latter-day Saints, The Church of Jesus Christ of. See Mormons.

U.S Capitol (about 1811) watercolor on paper (© Corbis)



A Latrobe water color portrays the architect's design for the United States Capitol in Washington, D.C. Latrobe worked on the Capitol from 1803 to 1812 and was responsible for much of the building's Neoclassical style.

Latvia, *LAT vee uh,* is a country on the Baltic Sea in northeastern Europe. The country's name in Latvian, the official language, is *Latvijas Republika* (Republic of Latvia). Riga is Latvia's capital and largest city.

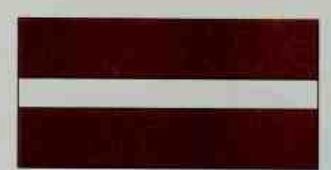
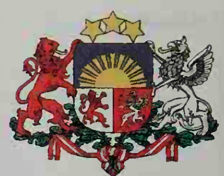
Latvia's rulers have included Germans, Poles, Lithuanians, Swedes, and Russians. The country was independent from 1918 to 1940, when the Soviet Union occupied it and forced it to become one of the 15 republics of the Soviet Union. Latvia regained its independence in 1991.

Government. Latvia has a legislature of 100 members, elected by the people to three-year terms. The legislature elects a president to a three-year term. The president serves as the ceremonial head of state. With the legislature's approval, the president chooses a prime minister and a cabinet. The prime minister heads the government and, with the aid of the cabinet, carries out government operations. For purposes of local government, Latvia is divided into 32 administrative regions.

The people. About half of the people are Latvians, also called *Letts.* They are ethnically related to the Lithuanians but have their own culture and language. Russians make up about a third of the population. Latvia also has small groups of Poles, Lithuanians, and Ukrainians.

Facts in brief

Capital: Riga.
Official language: Latvian.
Official name: Latvijas Republika (Republic of Latvia).
Area: 24,942 mi² (64,600 km²). *Greatest distances*—north-south, 170 mi (270 km); east-west, 280 mi (450 km). *Coastline*—293 mi (472 km).
Elevation: *Highest*—Gaizina (mountain), 1,020 ft (311 m). *Lowest*—sea level along the coast.
Population: *Estimated 2002 population*—2,305,000; density, 92 per mi² (36 per km²); distribution, 69 percent urban, 31 percent rural. *1989 census*—2,666,567.
Chief products: *Agriculture*—barley, dairy cattle, flax, hogs, oats, potatoes, sugar beets. *Manufacturing*—clothing, processed foods, textiles, transportation equipment, wood products.
Money: *Basic unit*—lat. One hundred santimi equal one lat.

Symbols of Latvia. The Latvian flag dates back to the 1200's, when it served as a banner in battle for one of the original Latvian tribes. The symbols on Latvia's coat of arms—a rising sun, a red lion, and a silver *griffin* (mythological creature)—stand for the three original provinces of Latvia.

The Latvian language is one of the oldest in Europe. It is related to Sanskrit, a language of ancient India.

Most of the people live in urban areas. Latvians generally wear Western-style clothing. But many Latvians wear colorful national costumes during holiday festivals. Latvians have a rich tradition of folklore, especially folk songs. Ice hockey is a favorite sport in Latvia, and many enjoy watching the national hockey team play. Basketball, soccer, and other sports are also popular. Many Latvians enjoy ballet, drama, and opera.

A majority of the people of Latvia belong to the Lutheran, Roman Catholic, or Russian Orthodox churches. Latvia has 10 colleges or universities, the largest of which is the Latvian State University in Riga.

Land and climate. Latvia, Estonia, and Lithuania are often called the Baltic States. These three countries make up a region that forms part of the large coastal plain of northern Europe. Latvia consists chiefly of low hills and shallow valleys. It has many small lakes and swamps. Forests cover about 40 percent of the land. The country's highest point is a hill that rises 1,020 feet (311 meters) above sea level.

Latvia's chief river is the Western Dvina (Daugava in Latvian). It flows northwest from Belarus through central



Tass from Sovfoto

Riga, the capital of Latvia, lies on the Western Dvina River (Daugava in Latvian) at the south end of the Gulf of Riga. It is Latvia's largest city and an important shipping and industrial center.

Latvia and empties into the Gulf of Riga. Latvia has about 293 miles (472 kilometers) of coastline. Many of its beaches are popular resort areas.

Temperatures in Latvia range from about 19 to 27 °F (−7 to −3 °C) in January to about 61 to 64 °F (16 to 18 °C) in July. Latvia receives from 20 to 31 inches (51 to 80 centimeters) of rain annually.

Economy. Service industries employ more than half of Latvia's work force. The main service industries are wholesale and retail trade, education, and health and social work. Other service industries of importance to the economy include government, real estate, and finance.

Manufacturing employs less than a fifth of Latvia's workers. The chief products include clothing and textiles, processed foods, transportation equipment, and wood products. Riga is Latvia's main industrial center. Other centers of manufacturing include Daugavpils, Liepāja, Rēzekne, and Ventspils.

About a fifth of the people of Latvia are employed in agriculture. Many farmers work on dairy and cattle farms. The chief farm products include barley, dairy cattle, flax, hogs, oats, potatoes, rye, and sugar beets.

Latvia also has a large fishing fleet. But heavy industrial development has caused major pollution of lakes, rivers, and the Baltic Sea.

History. People lived in what is now Latvia as early as 7000 or 8000 B.C. They were forced out about 2,000 years ago by invaders who became the ancestors of the Latvians. In time, these people established trade with Arabs, Estonians, Lithuanians, Romans, and other groups, and they developed their own language and culture.

Early rulers. The Vikings raided Latvia during the A.D. 800's, and Russian forces attacked several times in the 900's. The Teutonic Knights, an organization of German crusaders, invaded Latvia in the 1200's (see **Teutonic Knights**). War between the Latvians and the Knights lasted until the late 1200's, when the Latvians surrendered.



TASS from Sovfoto

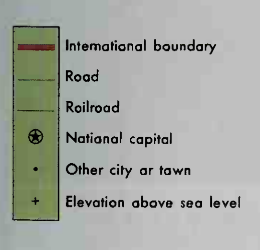
Traditional Latvian costumes are worn on special occasions, such as the song and dance festival shown here. Latvians generally dress in Western-style clothes.

For over 200 years, the Knights governed Latvia as part of a larger state called Livonia. But by 1562, most of Latvia had come under the rule of Poland and Lithuania. A German-ruled duchy was also set up there. Sweden conquered northern Latvia in 1621, and Russia took control of this area in 1710. By 1800, Russia ruled all of Latvia. But German merchants and landowners in Latvia continued to hold much political power.

Independence. During the late 1800's, the Latvians began to organize an independence movement. The movement became stronger in the early 1900's as Russian and German authority declined in Latvia. On Nov. 18, 1918,

Latvia







WORLD BOOK maps

just after the end of World War I, Latvia proclaimed itself independent. Russia and Germany tried to keep control of the new nation, but they finally recognized Latvia's independence in 1920.

In 1922, Latvia adopted a constitution that established a democratic form of government. The new democratic government passed land reform laws that broke up the large estates owned by a few wealthy people. The government divided this land into small farms and distributed the farms among the people.

In 1936, during the worldwide business slump called the Great Depression, democracy in Latvia suffered a setback. The country's president seized power and reduced the role of the parliament and the rights of the nation's political parties.

Soviet rule. In 1939, shortly before World War II began, the Soviet Union and Germany agreed secretly to divide much of eastern Europe between themselves. (The Soviet Union had been formed in 1922 under Russia's leadership.) The Soviet Union made Latvia sign a treaty that let the Soviets build military bases in Latvia. Soviet troops occupied Latvia in June 1940, and Latvian Communists took over the government. In August, the Soviets made Latvia part of the Soviet Union. German forces invaded Latvia in 1941. They occupied Latvia until 1944, when Soviet troops recaptured it.

Many Latvians tried to prevent the Soviets from taking over their country again. But the Soviets killed or deported those who opposed them.

Life in Latvia changed greatly under the Soviets. The Soviet Union established a powerful Communist government and took control of all industry and land. The Communist Party became Latvia's only legal political party. The Soviets banned the Latvian flag and national anthem.

The Soviets made Latvians use the Russian language. During most of the Soviet period, Russian was the first language in many government and business offices. It was also the primary language of most newspapers and television programs.

A growing number of Russian immigrants reduced the influence of the Latvian language and culture. Continuing Russian immigration threatened to make the Latvians a minority in their own land. At the time of the Soviet take-over, Latvians made up about 75 percent of the population. When the country regained its independence in 1991, Latvians accounted for about 52 percent of the population.

The Soviet Union restricted religion in Latvia by permitting religious services but no religious teaching. The Soviet Union also discouraged the people from going to church. For example, church attendance barred people from good educational and job opportunities.

Before Latvia became a Soviet republic, most of the people lived in rural areas. During the Soviet period, thousands of Latvians moved from the rural areas to the cities in order to work in various industries. Many apartment buildings in the cities date from that period.

Resistance to Soviet rule. Through the years, Latvians expressed their national spirit and opposition to Soviet rule. Latvian nationalism became especially strong during the mid-1980's, when Mikhail S. Gorbachev, the Soviet leader, began calling for greater openness of expression in the Soviet Union.

In 1988, Latvian reformers established the Popular Front—or People's Front—a large non-Communist organization. The Popular Front sought to gain for Latvia the rights to govern itself and to manage its own economy. Most members of the Latvian non-Communist groups sought complete independence from the Soviet Union.

Large numbers of Latvians showed their support for the aims of the Popular Front by holding demonstrations and by electing Popular Front representatives to the Soviet parliament that had been created in 1989. In the late 1980's, the government of the republic agreed to restore the national Latvian flag and anthem, and it began to allow freedom to the press and to religious groups. It restored Latvian as the common language. In addition, it began to lessen government control of the economy. The government began to allow private businesses and farms.

Independence regained. In late December 1989, Latvia's parliament voted to end the Communist Party's monopoly on power. A multiparty political system was established in January 1990. In February, the parliament condemned the Soviet Union's 1940 take-over of Latvia. New parliamentary elections were held in March. Candidates who favored independence from the Soviet Union won a two-thirds majority of the parliamentary seats. On May 4, 1990, the parliament declared the restoration of Latvian independence and called for a gradual separation from the Soviet Union. The Soviet government called the declaration illegal.

In August 1991, several conservative Communist officials failed in an attempt to overthrow Gorbachev and take over the Soviet Union's central government. In the upheaval that followed, Latvia declared immediate independence. In September, the Soviet Union recognized Latvia's independence. In December, most of the Soviet republics formed a loose association called the Com-



© Peter Stone, Black Star

Latvians tear down a Soviet monument in Riga after Latvia declared itself independent of the Soviet Union in August 1991. In September, the Soviet Union recognized Latvia's independence. It had forcibly made Latvia a Soviet republic in 1940.

monwealth of Independent States. Latvia declined to join because it feared that Russia would control the association. On December 25, the Soviet Union was dissolved.

After becoming independent, Latvia sought closer economic and political ties with the countries of Western Europe. The government continued reducing its control of the economy, and most farms and many businesses became privately owned.

Latvian efforts to limit the rights of Russians living in Latvia angered Russia. In 1998, voters in Latvia approved a referendum to amend the country's citizenship laws. The amendments made it easier for Russians living in Latvia to become Latvian citizens. Jaroslaw Bilocerkowycz

See also **Baltic States; Riga.**

Laud, *lawd,* **William** (1573-1645), was the dominant figure in the Church of England during the disputes that led to the outbreak of the English Civil War in 1642. Because the Church of England was the national church, Laud believed that all English people should conform to it. He directed his efforts to enforce uniformity mainly against the Puritans, who wanted the church to adopt simpler forms of organization and worship.

Laud was born on Oct. 7, 1573, in Reading. He attended Oxford University and became a clergyman in 1601. Laud rose to prominence under Charles I, who became king in 1625. In 1633, Laud became archbishop of Canterbury, the highest-ranking bishop in England. As archbishop, he used the royal courts of the Star Chamber and High Commission to put down religious observances that did not conform to those of the national church. Laud also withdrew the preaching licenses of Puritan ministers and had Puritans imprisoned. All these acts aroused considerable opposition to both Laud and the king and eventually contributed to the Civil War.

In 1640, the Parliament had Laud arrested on charges of high treason. The charges were flimsy, but he was beheaded on Jan. 10, 1645. Dale A. Johnson

See also **England** (The Civil War); **Puritans.**

Laughing gas. See **Nitrous oxide.**

Laughton, *LAW tuhn,* **Charles** (1899-1962), was an English-born actor who won fame for his strong character roles. Laughton made his stage debut in London in 1926. He made his film debut in England in 1929 and in the United States in 1932. Laughton won the Academy Award for best actor for *The Private Life of Henry VIII* (1933). His most celebrated performances came in *The Barretts of Wimpole Street* (1934), *Ruggles of Red Gap* (1935), *Les Misérables* (1935), *Mutiny on the Bounty* (1935), *Rembrandt* (1936), *The Hunchback of Notre Dame* (1939), *The Suspect* (1945), *Hobson's Choice* (1954), and *Witness for the Prosecution* (1958). He directed one movie, the allegorical suspense drama *The Night of the Hunter* (1955). He was born on July 1, 1899, in Scarborough, and became a U.S. citizen in 1950. Laughton died on Dec. 15, 1962. Louis Giannetti

Launfal, *LAWN fuhl,* **Sir,** was a knight of King Arthur's Round Table in British legend. He was the hero of several literary works. The earliest-known one, *Lai de Lanval,* was written in the late 1100's by the French poet Marie de France. In this story, Launfal falls in love with a beautiful fairy. She gives him wealth and happiness but makes him promise not to reveal their source. The American poet James Russell Lowell wrote the best-known modern story of Launfal, *The Vision of Sir Launfal* (1848). Edmund Reiss

See also **Lowell, James Russell** (Literary success).

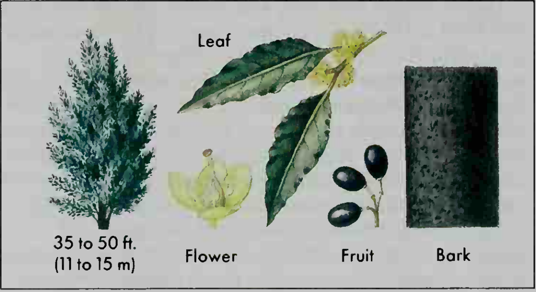
Laura Ingalls Wilder Award is presented to an author or illustrator who has made "a lasting and substantial contribution" to children's literature. The Association for Library Service to Children, a division of the American Library Association, selects the winner. The award was established in 1954 to honor Laura Ingalls Wilder, an American author best known for her "Little House" series. The award, a bronze medal, depicts Wilder as a child holding a doll. The award was given every five years from 1960 to 1980. Since 1980, it has been given every three years. Marilyn Fain Apseloff

Laura Ingalls Wilder Award winners

Year	Winner	Year	Winner
1954	*Laura Ingalls Wilder	**1986**	Jean Fritz
1960	Clara Ingram Judson	**1989**	*Elizabeth George Speare
1965	*Ruth Sawyer	**1992**	*Marcia Brown
1970	*E. B. White	**1995**	*Virginia Hamilton
1975	*Beverly Cleary	**1998**	Russell Freedman
1980	Theodor Geisel (*Dr. Seuss)	**2001**	Milton Meltzer
1983	*Maurice Sendak		

*Has a separate biography in *World Book.*

Laurel is a family of trees and shrubs that grow mostly in tropical and subtropical areas. The *true laurel,* also called *sweetbay,* grows near the Mediterranean Sea.



WORLD BOOK illustration by Christabel King

The true laurel is found in the Mediterranean region. It has smooth, shiny leaves and bears yellow flowers and dark-colored berries. Laurels grow mainly in areas with hot or warm climates.

Ancient Greeks used its leaves to crown victorious athletes. The leaves have a spicy odor. They are called *bay leaves* when dried and are used in cooking. Many other members of the laurel family, including camphor, cinnamon, and sassafras, also have spicy-smelling leaves. The avocado also belongs to the laurel family. The *California laurel,* also known as the *Oregon laurel* or *myrtlewood,* grows along the Pacific Coast. Its rich, light-brown wood is valued for furniture and decorations.

Plants of other families are called laurels. *Cherry laurel,* also called *English laurel,* is a group of evergreen cherry trees in the rose family. The *mountain laurel* is in the heath family. Douglas G. Sprugel

Scientific classification. The true laurel is in the laurel family, Lauraceae. Its scientific name is *Laurus nobilis.* The California laurel is *Umbellularia californica.*

See also **Avocado; Camphor; Cinnamon; Mountain laurel; Sassafras.**

Laurel and Hardy were the most popular comedy team in American motion-picture history. Stan Laurel (1890-1965) played a timid little dimwit. He continually exasperated his partner, Oliver (Ollie) Hardy (1892-1957), who played a fat, bullying know-it-all. The team starred in more than 60 short films and 27 feature movies from 1926 to 1952. Unlike most stars of the silent film era, Laurel and Hardy also made successful sound films.



Scene from *Helpmates* (1931); the Granger Collection

Laurel and Hardy formed a famous film comedy team. Hardy, *left,* played a blustery character. Laurel was his dumb partner.

Laurel, whose real name was Arthur Stanley Jefferson, was born in Ulverston, England, and began his career in vaudeville. He came to the United States in 1910 and made his first film in 1917. Oliver Norvell Hardy was born in Harlem, Ga. He made his first short comedies in 1913 and moved to Hollywood in 1918. Laurel and Hardy first teamed up in 1926 in *Putting Pants on Philip,* which was released in 1927. Their later films included *Babes in Toyland* (1934), *Sons of the Desert* (1934), *Way Out West* (1937), and *Blockheads* (1938). Charles Champlin

Lauren, *LAWR uhn,* **Ralph** (1939-), is an American fashion designer who created a vast retailing network and successful marketing program to sell his designs. Lauren markets his products under the Polo/Ralph Lauren label. Clothing and home furnishings carrying this label convey an image of timeless elegance, tradition, and wealth combined with the active, rough-and-ready image of the American West. Lauren focuses on quality, simplicity, and durability in his designs. He is famous for his attention to detail, demanding the realization of his ideas down to the smallest particulars.

Lauren was born in New York City. He began his career designing and marketing men's neckties. In 1968, he founded Polo Fashions, Inc., a menswear company. He expanded his product line to include women's wear, children's clothes, leather goods and other accessories, cosmetics, and home furnishings. He markets his products through an international network of retail stores and license agreements. Jean L. Druesedow

Laurence, Margaret (1926-1987), was a Canadian author. She is best known for her vivid and sympathetic portraits of women in her fiction. Such portraits appear in her five novels set in the fictional prairie town of Manawaka. The novels are *The Stone Angel* (1964), *A Jest of God* (1966), *The Fire-Dwellers* (1969), *A Bird in the House* (1970), and *The Diviners* (1974).

Laurence was born in Neepawa, Man. Her given and family name was Jean Margaret Wemyss. She was married to Jack Laurence from 1947 to 1969. From 1950 to 1957, Laurence traveled with her husband in Africa as he worked on engineering projects. She wrote a personal account of her experiences in what is now Somalia in *The Prophet's Camel Bell* (1963, reprinted as *New Wind in a Dry Land*). The novel *This Side Jordan* (1960) and the short-story collection *The Tomorrow-Tamer* (1963) describe Africa's struggle to modernize. Laurence also wrote four children's books and two collections of essays, *Heart of a Stranger* (1976) and *Dance on the Earth: A Memoir* (published in 1989). Ronald B. Hatch

Laurencin, *law rahn SAN,* **Marie** (1885-1956), was a French painter and designer. Her best-known images portray young women, often during moments of leisure. Laurencin created a youthful, slender female type associated with the fashionable dress of the 1920's. She painted in a decorative style readily adapted to graphic art and commercial design. She became a successful portrait painter and designer of book illustrations, stage sets, wallpaper, and textiles.

Laurencin was born in Paris. As a female artist whose work focused on decorative, female imagery, she was not always taken seriously in art circles dominated by men. Nancy J. Troy

Laurentian Plateau. See Canadian Shield.



In the Park (1924), an oil painting on canvas; National Gallery of Art, Washington, D.C., the Chester Dale Collection

A Laurencin painting portrays a group of young women in casual poses. The pale colors are typical of the artist's style.

Sir Wilfrid Laurier



Prime Minister of Canada
1896-1911



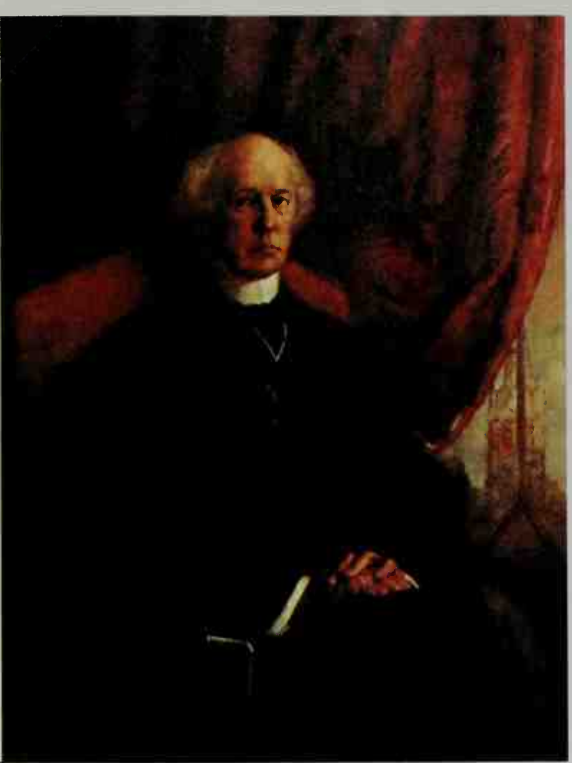
Tupper
1896



Laurier
1896-1911



Borden
1911-1920



Detail of a portrait by John Russell; House of Commons, Ottawa (John Evans)

Laurier, *LAW rih ay,* **Sir Wilfrid** (1841-1919), was the first French Canadian to become prime minister of Canada. He held the office from 1896 to 1911. Laurier served in Parliament for 45 years and was leader of the Liberal Party for 32 years. Throughout his long public career, Laurier worked to unite French-speaking and English-speaking Canadians for the good of Canada. He also laid the foundation for Canadian independence by opposing strong ties with the British Empire. During Laurier's term as prime minister, Canada enjoyed great prosperity. The settlement of western Canada led to the establishment in 1905 of two new western prairie provinces—Alberta and Saskatchewan.

The "Old Chief," as many called Laurier, looked like a model of an aristocrat. He wore a black frock coat with a vest. His coat lapels were lined with a white frill. His collar rose high and straight, and his tie was so wide that it hid his shirt.

Laurier spoke English and French fluently. He became one of the outstanding orators in Canadian history. He used few gestures as he spoke, but the rich tones of his voice often held audiences spellbound.

Early life

Boyhood and education. Wilfrid Laurier was born on Nov. 20, 1841, in Quebec in the village of St. Lin (now Laurentides), near L'Épiphanie. His ancestors had come to Canada from Normandy, France. One of them was a soldier under Paul de Chomedey, Sieur de Maisonneuve, who founded Montreal in 1642.

Wilfrid's mother, Marie Marcelle Martineau Laurier, died when he was 6 years old. His father, Carolus Laurier, later married Adelaine Ethier. Wilfrid had three half brothers and a half sister.

Carolus Laurier was a farmer and surveyor. A man of strong liberal beliefs, he did not want Wilfrid to grow up knowing only the French culture. When Wilfrid was about 11, his father sent him to live for two years with a Scots-Canadian family in a neighboring village. There the boy learned the English language and became familiar with English ways of life.

Laurier attended L'Assomption College, a French-Canadian school in L'Assomption, Que. He liked public speaking and helped form a debating society there.

In 1861, Laurier began to study law at McGill University in Montreal. His father had little money at this time, and Wilfrid took a part-time job with the Montreal law firm of Laflamme and Laflamme. Rodolphe Laflamme, the head of the firm, was an active Liberal. Laurier received his law degree in 1864.

Young lawyer. Laurier practiced law in Montreal for two years after his graduation. In 1866, he developed a serious lung ailment. At the suggestion of a friend, Laurier moved to Arthabaska, a new settlement in eastern Quebec. He hoped the country air would restore his health. In Arthabaska, he became a popular and successful lawyer. He also edited the newspaper *Le Défricheur* for about six months. Laurier wrote editorials that Roman Catholic leaders considered too radical. The newspaper went out of business, chiefly because of lack of funds.

Laurier married Zoë Lafontaine (1841-1921) of Mon-

treal on May 13, 1868. The couple lived in Arthabaska until Laurier became prime minister. They often returned there for rest during the busy years that followed. The Lauriers had no children.

Early public career

In 1871, at the age of 29, Laurier was elected to the Quebec legislature as a Liberal. Three years later, in 1874, Laurier was elected to the federal parliament in Ottawa.

The poet Louis-Honoré Fréchette described reaction to Laurier's first speech in the House of Commons: ". . . Who could be this young politician . . . who thus, in a maiden speech handled the deepest public questions with such boldness and authority? . . . On the following day, the name of Laurier was on every lip. . . . It seemed as if every one realized that a future chieftain had just proclaimed himself. . ."

In 1877, Laurier accepted the invitation of Prime Minister Alexander Mackenzie to join his cabinet as minister of inland revenue. He held the office for less than a year because the Liberals were defeated in the 1878 election. For the next 18 years, until he became prime minister, Laurier sat on the opposition side of the House of Commons.

During the late 1800's, the Liberals in Quebec met strong opposition from the Roman Catholic Church. In 1877, Laurier made a speech on liberalism that became a classic in Canadian political history. In this speech, he distinguished between liberalism in politics and liberalism in religion. Laurier declared that French-Canadian Catholics had the right to form their own political opinions without interference from the church. But he warned against the possible creation of a French-Canadian Catholic political party. Such a party, Laurier said, would inevitably be met by an English-Canadian Protestant party that would oppose the French Canadians. And, he pointed out, most Canadians were English-speaking Protestants.

In 1880, Edward Blake succeeded Alexander Mackenzie as leader of the Liberal Party. Laurier became Blake's aide and leader of the party's Quebec wing.

The execution of Louis Riel in 1885 brought Laurier back into the spotlight. Riel had led a rebellion of *métis* (people of mixed white and Indian ancestry) in Saskatchewan against the federal government. The métis re-

Important dates in Laurier's life

1841 (Nov. 20) Born in St. Lin, Que.
1871 Elected to the Quebec legislature.
1874 Elected to Parliament.
1877 Appointed minister of inland revenue.
1887 (June 7) Elected leader of the Liberal Party.
1896 (July 11) Became prime minister of Canada.
1897 Knighted by Queen Victoria.
1899 Sent Canadian troops to aid Britain in the Boer War.
1905 Alberta and Saskatchewan became provinces.
1910 Proposed building a Canadian navy.
1911 (Sept. 1) Resigned as prime minister after the Liberals lost the election.
1917 Refused to join the coalition Union Government in support of conscription.
1919 (Feb. 17) Died in Ottawa.

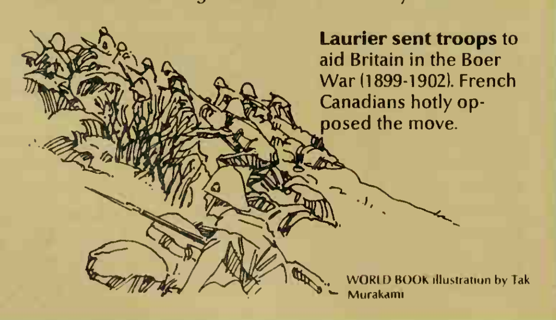
WORLD BOOK illustration by Tak Murakami

Important events during Laurier's administration



Public Archives of Canada

Homesteaders, lured by rich lands, rapidly settled western Canada during the late 1800's and early 1900's.



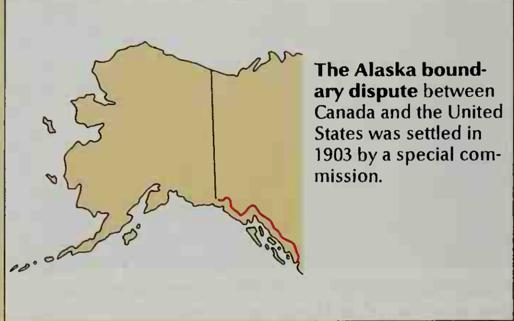
Laurier sent troops to aid Britain in the Boer War (1899-1902). French Canadians hotly opposed the move.

WORLD BOOK illustration by Tak Murakami



The Manitoba school issue involved religious instruction and the use of French. Laurier worked out a compromise soon after taking office as prime minister.

WORLD BOOK map



The Alaska boundary dispute between Canada and the United States was settled in 1903 by a special commission.

volted in fear of being thrown off their lands. Riel was captured and sentenced to death. Many French Canadians considered Riel a hero, and demanded that he be pardoned. But many English Canadians demanded his death for treason. Prime Minister Sir John A. Macdonald let the sentence stand, and Riel was hanged. See **Riel, Louis.**

French Canadians in Montreal staged a demonstration against Riel's execution. Laurier joined in the protest. He declared that if he had lived along the Saskatchewan River, where the revolt started, he would have shouldered his musket along with the métis. Blake joined Laurier in protesting Riel's execution. But most Liberals outside Quebec refused to follow them. The Conservatives won the 1887 election.

The Liberal Party had now lost three successive elections—in 1878, 1882, and 1887. In despair, Blake resigned as Liberal Party leader. He advised the party to elect Laurier as his successor. On June 7, 1887, Laurier became leader of the Liberal Party. Most English-speaking Liberals, as well as Laurier himself, felt that because he was a French Canadian he could never win the support of English-speaking Canadians.

Laurier wanted to distract attention from the bitter English-French quarrel over Riel. Partly in an effort to do so, he proposed an unrestricted reciprocal trade agreement with the United States (see **Reciprocal trade agreement**). Prime Minister Macdonald opposed such a pact. He declared that completely free trade would lead to eventual political union with the United States. In the election of 1891, Macdonald and the Conservatives defeated Laurier and the Liberals on the issue of trade with the United States.

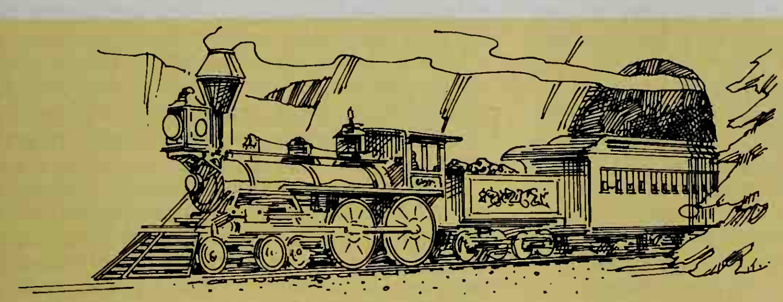
Macdonald died in June 1891. During the next five years, the Conservative Party slowly lost popularity under the leadership of four Conservative prime ministers—Sir John J. C. Abbott (1891-1892), Sir John S. D. Thompson (1892-1894), Sir Mackenzie Bowell (1894-1896), and Sir Charles Tupper (1896).

The Manitoba school issue brought Laurier and the Liberals to power. In 1890, the Manitoba legislature had abolished tax support for Roman Catholic schools in the province. It felt that one school system for all children would be more efficient than separate public and Roman Catholic schools. Catholics in Manitoba charged that they were being deprived of their constitutional rights. In 1895, the Canadian government ordered Manitoba to restore tax funds to the Catholic schools. Manitoba refused. In 1896, the Conservative government introduced a bill providing for separate schools in Manitoba. The issue was hotly debated in the election of that year. Laurier declared that a compromise could be reached by "sunny ways" rather than by force. Although many Roman Catholic leaders opposed Laurier, French Canadians supported him. The Liberals won the election.

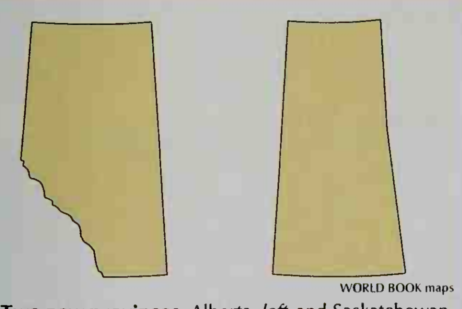
Prime minister (1896-1911)

At the age of 54, Wilfrid Laurier took office as prime minister of Canada on July 11, 1896. He succeeded Sir Charles Tupper, a Conservative. Laurier soon worked out a compromise solution in the Manitoba school

WORLD BOOK illustration by Tak Murakami



Railways, built with the aid of Laurier's government, helped speed the development of the prairies during the early 1900's.



WORLD BOOK maps

Two new provinces, Alberta, *left,* and Saskatchewan, *right,* joined Canada during Laurier's administration. Both joined on Sept. 1, 1905.



F. Chartrand, Canapress

Laurier House in Ottawa, Ont., was the home of two prime ministers—Laurier and W. L. Mackenzie King.

problem. The province agreed to permit religious teaching and the use of French during certain periods of the school day. The amount of such instruction was based on the number of pupils who desired it.

When Laurier came to power, a long period of falling prices was ending. Europe had grown prosperous and had become a booming market for Canadian wheat and other food products. Laurier acted to take advantage of the favorable economic situation. During his administration, the government helped about 2 million immigrants enter Canada. Most of the newcomers settled on the western prairies. The government also helped build the Canadian Northern and the Grand Trunk Pacific railways to carry out the wheat that the settlers grew. The country enjoyed its greatest prosperity since 1867. The Liberals won reelection in 1900, 1904, and 1908. Queen Victoria knighted Laurier in 1897.

Prosperity helped soften the conflict between French and British Canadians. But in 1905, when the government established two new provinces—Saskatchewan and Alberta—Laurier allowed each of them to have a separate Roman Catholic school system. Another storm over religion and education arose.

Relations with the United Kingdom caused further hostility between British and French Canadians. The chief question was what action Canada would take if the United Kingdom should go to war.

In 1897, the British colonial secretary, Joseph Chamberlain, suggested closer economic ties between members of the British Empire. Laurier's government agreed that year to decrease tariffs on British goods. But Laurier opposed any system that would bind the United Kingdom and the British colonies in one economic unit. Laurier maintained his opposition to the empire as a close-knit unit at the four Imperial Conferences that he attended in 1897, 1902, 1907, and 1911.

In 1899, the United Kingdom went to war against the Boers in South Africa (see **Boer War**). British Canadians demanded that Canada send troops to aid the United Kingdom. French Canadians opposed any government aid to the United Kingdom. Laurier spent government funds to equip Canadian volunteers and send them to Africa. French Canadians protested strongly. Even Henri Bourassa, Laurier's most promising French-Canadian lieutenant, rebelled against the policy. From then on, French Canadians and British Canadians became more divided on Canada's role in the British Empire.

By 1910, the United Kingdom faced the threat of war with Germany. Laurier decided to build a Canadian navy to support the United Kingdom if war began. Parliament approved his Naval Service Bill, but many Canadians opposed it. Some French Canadians thought Laurier "too British" because he had supported the United Kingdom. Some British Canadians considered him "too French" because of his opposition to closer ties with the United Kingdom.

Defeat. In 1911, the United States offered Canada a limited reciprocal trade treaty. Laurier accepted, and the governments drew up an agreement that seemed to give equal benefits to each. But some Canadians still feared domination by the United States. Many resented the 1903 settlement of the Alaska border dispute between the two countries (see **Alaska** [The early 1900's]).

The Liberals lost the election of September 1911, chiefly because of the public's opposition to the naval bill and the trade agreement with the United States. In Quebec, Bourassa helped defeat Laurier by forming an alliance with the Conservatives. Robert L. Borden, a Conservative, became prime minister.

Later years

The conscription crisis. For the rest of his life, Sir Wilfrid Laurier continued to serve as leader of the Liberal Party. When World War I began in 1914, he supported the Conservative government in joining the war to aid the United Kingdom.

As the war dragged on, it became clear that far fewer French Canadians than British Canadians were enlisting for military service. By 1917, the Canadian forces fighting in Europe needed replacements. Until then, all Canadian servicemen had enlisted voluntarily. Prime Minister Borden decided that *conscription* (drafting of men for military service) had become necessary. Borden wanted both parties to approve conscription so that unity could be kept among all Canadians. To carry out the policy, Borden asked Laurier to join a Union Government made up of Liberals and Conservatives. Laurier refused. He felt he would lose control of the Liberals in Quebec if he joined the proposed government. Bourassa and his followers also firmly opposed conscription. They felt they had no direct responsibility in the war.

Most of Laurier's British Canadian followers broke away from him and helped Borden form the Union Government. They felt that Laurier was too concerned with keeping his hold on Quebec and that he did not consider the national interests of Canada as a whole. But Laurier felt it would be dangerous if Bourassa's radical nationalism replaced his moderate leadership.

In the election of December 1917, British Canadians voted overwhelmingly for the Union Government. Prime Minister Borden stayed in power. But most French Canadians voted against the Union Government and conscription.

The split between British and French Canadians saddened Laurier. Ever since entering Parliament more than 40 years before, he had worked to unite the two groups. But later events proved that his efforts had not been in vain. After Laurier died in 1919, W. L. Mackenzie King reunited French Canadian and British Canadian Liberals.

Death. Sir Wilfrid Laurier died on Feb. 17, 1919, at the age of 77. He was buried in Ottawa. Lady Laurier died in 1921. In her will, she left Laurier House, their home in Ottawa, to Mackenzie King. After King died in 1951, the Canadian government made Laurier House a museum. Laurier's birthplace at St. Lin is a national historic site.

Jacques Monet

Related articles in *World Book* include:

Borden, Sir Robert L.
Bourassa, Henri
Canada, Government of
Canada, History of
King, W. L. Mackenzie
Macdonald, Sir John A.
Mackenzie, Alexander
Prime minister of Canada
Quebec (History)

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Lausanne, Switzerland, is a famous tourist center. The city is built on hills nestled along the northern shore of beautiful Lake Geneva.

Spigelman, Martin. *Wilfrid Laurier.* Rev. ed. Fitzhenry & Whiteside, 2000. Younger readers.

Lausanne, *loh ZAN* or *loh ZAHN* (pop. 128,112; met. area pop. 294,604), is a city in western Switzerland, on the north shore of Lake Geneva. For the location of Lausanne, see **Switzerland** (political map). Lausanne is a major center of tourism and the commercial and industrial center of its region. The city also serves as the capital of the *canton* (state) of Vaud. It is the home of the Federal Tribunal, Switzerland's highest court.

Lausanne is a hilly city with steep roads. Huge bridges connect some of the hills. Lausanne's landmarks include a medieval castle and a medieval Gothic cathedral with beautiful stained-glass windows. Its many industries include printing, woodworking, and the manufacture of chemicals, metal products, and radios.

Roman soldiers established a colony on the site of what is now Lausanne in about 50 B.C. The Swiss city of Bern conquered Lausanne and the rest of Vaud in 1536. Vaud gained independence in the late 1700's. In 1803, it joined the union of Swiss cantons called the Swiss Confederation. Heinz K. Meier

Lausanne, Treaty of. See **Greece** (World War I).

Lava is molten rock that pours out of volcanoes or from cracks in the earth. It comes from deep in the earth where the heat is great. There, lava is called *magma.* When lava first comes to the surface it is red-hot, reaching temperatures from 7 to 12 times hotter than boiling water.

Properties of lava. Lava is a solution of silicate minerals (see **Silica**). It is similar to the hot liquid that would result if granite or basalt were melted. When lava cools rapidly, only a few crystals can form. The lava hardens into a rock that contains large amounts of natural glass.

The volcanoes or earth *fissures* (cracks) that contain the lava are sometimes explosive. From time to time, they blow out quantities of dust and rock fragments that form layers between lava flows. Some types of lava



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Red-hot, fiery lava may reach temperatures from 7 to 12 times as hot as boiling water. The photograph shows lava flowing from Nyiragongo, a volcano in eastern Congo (Kinshasa).



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Cooling lava hardens into various formations. Highly fluid lava forms smooth, folded sheets of rock, such as those found in the Galapagos Islands. Stickier lava produces jagged sheets.

contain large amounts of dissolved gases. As the gases expand, they are trapped in the lava and form many bubbles. *Pumice* is a type of lava that has many bubbles.

Lands that were once covered with lava often become quite fertile after weathering has broken the lava into fine soil. Some lavas, such as a glassy lava called *perlite,* are heated in furnaces. They expand into a frothy material used to manufacture lightweight concrete.



Spongelike rock forms from lava with a high gas content. As such lava cools, it traps the gases and creates bubbles.



Grant Heilman

Glassy rock results from lava that cools and hardens so quickly that only a few crystals can form.

Kinds of lava. There are two kinds of lava. One kind, called *aa,* is *viscous* (sticky) and moves slowly. The other kind, called *pahoehoe,* is so fluid that when it first erupts it flows down the side of a volcano faster than a person can run. Both kinds cool at the surface first, forming a solid crust over a liquid core.

Sometimes the liquid lava inside the crust cracks the hardened lava surface into many rough blocks that drag and tumble along as the lava creeps down the side of the volcano. At other times, the lava breaks a hole through the rocky crust and flows through, leaving a huge lava cave or tunnel. In Idaho, in the area of the Craters of the Moon, a person can walk into many lava caves that were formed only a few thousand years ago. The surface of such lava is covered with many wrinkles.

Location of lava beds. Many regions of the earth consist of piled-up sheets of lava. In the Northwestern United States, the Columbia lava plateau is made up of a great lava pile more than 5,000 feet (1,500 meters) thick in places. The islands of Hawaii are a chain of volcanoes built mostly of lava. The mountain belt of southern Mexico also has a great lava pile. Katharine V. Cashman

See also **Igneous rock; Pumice; Rock** (Igneous rock); **Volcano.**

Lava Beds National Monument is in northern California. It includes exhibits of volcanic action, lava flows, and caves. The monument, established in 1925, was the battleground for most of the Modoc Indian War (1872-1873). For its area, see **National Park System** (table: National monuments).

Laval, *luh VAL* (pop. 343,005), is is one of the largest cities in Quebec. A part of the Montreal metropolitan area, it is located on Jésus Island, which lies just north of Montreal where the Ottawa and St. Lawrence rivers meet. Seven bridges link Laval with Montreal. For location, see **Quebec** (political map). Laval factories manufacture furniture, food products, industrial machinery, aluminum, iron and steel, electrical appliances, wood and paper products, chemical and pharmaceutical products, clothing, transportation equipment, and sports equipment.

In 1681, four French families settled on the island. Eventually, 14 small towns were formed there. In 1965, these towns were combined to form Laval. The city has a mayor-council government. Hubert Charbonneau

Laval, *luh VAL,* **Pierre** (1883-1945), was a French politician who collaborated with the Germans during World War II. After the Germans invaded France in May 1940, Laval urged surrender. He served as the head of government in Vichy France during 1940 and again from 1942 until the liberation of France in 1944. Both times he held office under Henri Pétain, Vichy France's chief of state (see **Pétain, Henri Philippe; Vichy**). After Germany surrendered in 1945, Laval was handed over to the new French government and was convicted of treason. He swallowed poison in a suicide attempt on the day of his execution. But the attempt failed, and he was shot by a firing squad.



United Press Int.

Pierre Laval

Laval was born on June 28, 1883, in Auvergne province in southern France. He studied at the universities of Lyon and Paris. In 1914, he was elected to the French Chamber of Deputies, and after World War I (1914-1918), he began to rise in politics. He held several cabinet posts and was premier twice. In 1935, as premier, he shared in the Hoare-Laval Agreement, proposing that France and Britain negotiate peace between Italy and Ethiopia. In 1938, he supported the Munich Agreement, giving Germany part of Czechoslovakia. John F. Sweets

Laval de Montmorency, *luh VAL duh mawn maw rahn SEE,* **François Xavier de,** *frahn SWAH gzah VYAY duh* (1623-1708), was the first Roman Catholic bishop of the city of Quebec. Quebec was then the capital of New France, a French colony that included much of Canada and part of what is now the United States.

Laval was a major figure in the religious and civil affairs of the colony from 1659 until he retired in 1688. He founded the Seminary of Quebec (now Laval University) in 1663 to train priests for work in New France. Laval tried to end practices he thought evil. His efforts caused conflicts between him and government officials. For example, he tried to prevent traders from selling liquor to Indians. But government officials who wanted to protect the traders opposed him.

Laval was born April 30, 1623, in Montigny-sur-Avre, near Paris. He became a Jesuit priest in 1647 and a bishop in 1658. He was sent to Quebec in 1659. P. B. Waite

Laval University, *luh VAL,* also called Université Laval, is a coeducational school in Quebec City, Quebec. Founded in 1663 as the Seminary of Quebec, the school was granted a royal charter as Laval University in 1852. It received a new charter from the provincial government in 1970. Laval University offers courses in all major fields and grants bachelor's, master's, and doctor's degrees. In-

struction at Laval University is in French.

Critically reviewed by Laval University

See also **Quebec** (picture: Laval University).

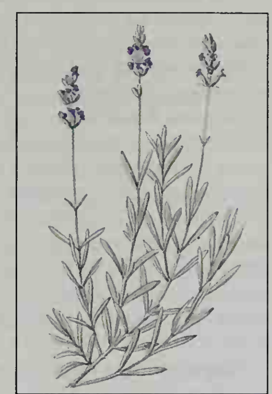
Lavender is the name of about 20 species of small bushes that bear fragrant flowers and leaves. Lavender belongs to the mint family. It grows wild in Mediterranean countries and is widely cultivated.

Lavender bushes grow from 3 to 4 feet (91 to 120 centimeters) high. They have long, narrow, pale green leaves and pale purple flowers. This shade of purple is called *lavender* after the flowers. The flowers grow in clusters around the stem. When dried, they keep their fragrance for a long time.

Lavender comes from a Latin word that means *to wash.* This name may have been used because the ancient Romans used the leaves and flowers of the plant to scent their bathwater.

Women once routinely stored dried lavender flowers with their linens and clothing. Today, the dried flowers are used in fragrant *sachets* (powders) and *potpourris* (mixtures). The flowers also are distilled to make an oil that is used in some perfumes.

Donna M. Eggers Ware



WORLD BOOK illustration by Christabel King

Lavender

Scientific classification. Lavender bushes belong to the mint family, Lamiaceae or Labiatae, and make up the genus *Lavandula.*

See also **Mint; Perfume.**

Lavender Pit, one of the world's largest open-pit copper mines, is in Bisbee, Arizona. It is owned by the Phelps Dodge Corporation. The mine is named after Harrison M. Lavender, a company officer who carried out the plan to produce valuable copper ore from low-grade copper-bearing rock. Production of the ore began in 1954. Alice B. Good

Laver, Rod (1938-), became one of the leading tennis players of all time. He was born the year that Don Budge became the first man to win the Australian, British, French, and United States championships. In 1962, Laver became the only man to equal Budge's feat. In 1969, Laver again won the *grand slam* of tennis. He was the first player to do so twice.

Rodney George Laver was born in Rockhampton, Australia, and played on four winning Australian Davis Cup teams. He lost two Davis Cup matches in 1959 but won all six of his singles events in the 1960, 1961, and 1962 Davis Cup finals. Laver became a professional player in 1963. Arthur Ashe

Laveran, *LAH VRAHN,* **Charles Louis Alphonse** (1845-1922), a French physician, discovered the parasite that causes malaria. He also made other contributions to the knowledge of tropical diseases. He received the 1907 Nobel Prize in medicine.

In Algeria, in 1880, Laveran recognized the malaria parasite in the blood of soldiers who were suffering from the disease. As early as 1884, he became convinced that mosquitoes played an important part in spreading the disease. In 1892, Laveran described several species of *trypanosomes,* the parasites that cause sleeping sickness.

Laveran was born in Paris. He completed his medical studies in Strasbourg in 1867. He served as a military physician until 1896. The next year, he joined the Pasteur Institute in Paris. Matthew Ramsey

La Vérendrye, *lah vay RAHN dree,* **Sieur de** (1685-1749), Pierre Gaultier de Varennes, was a French-Canadian fur trader and explorer. In 1731, La Vérendrye, three of his sons, and a nephew set out from Montreal to find an overland route to the Pacific Ocean. They got as far west as what are now Saskatchewan and the Dakotas by 1738. Two of the sons may have reached the Rocky Mountains in 1742. Along the way, La Vérendrye established outposts that served as forts and fur-trading stations, and he claimed much land for the French king. His reports added to the knowledge of the geography of the area. His fur-trading business was unprofitable, and he returned to Montreal in 1743.

La Vérendrye was born in Trois-Rivières, Quebec. He served in the French Army in Canada and France before he began exploring. P. B. Waite

See also **Manitoba** (History); **North Dakota** (History); **South Dakota** (History).

Lavoisier, *LAH VWAH ZYAY,* **Antoine Laurent** (1743-1794), was a French chemist. He is regarded as the founder of modern chemistry.

Lavoisier carefully measured the weights of substances involved in chemical reactions. In 1772, he began a series of experiments that demonstrated the nature of *combustion* (burning). He concluded that combustion results from the rapid chemical union of a flammable material with a newly discovered gas, which he called oxygen. Lavoisier also found that the weight of the products of combustion equals the weight of the reacting ingredients. This observation became known as the law of conservation of mass (or matter). Lavoisier reported his findings in his *Elementary Treatise on Chemistry* (1789), which is considered the first modern textbook on chemistry.

With French astronomer and mathematician Pierre Simon Laplace, Lavoisier conducted experiments on respiration in animals. Their studies demonstrated a similarity between common chemical reactions and the processes that occur in living organisms. These experiments provided the foundation for the science now known as biochemistry. Lavoisier also helped develop a system for naming chemical substances based on their composition. This system is still in use.

Lavoisier was born in Paris. He received an excellent education and developed an interest in all branches of science, especially chemistry. He was elected to the French Academy of Sciences in 1768.

Lavoisier was arrested in 1793 by the leaders of the French Revolution. Many years earlier, he had become a partner in a firm that collected a number of taxes for the government. In spite of his achievements, Lavoisier was found guilty of conspiracy with the enemies of France because of his involvement in tax collection. He was executed by guillotine. Melvyn C. Usselman

See also **Chemistry** (Lavoisier's contributions; picture); **Oxygen.**

Law is the set of enforced rules under which people are governed. Law is one of the most basic social institutions—and one of the most necessary. No society could exist if all people did just as they pleased, without regard for the rights of others. Nor could a society exist if its members did not recognize that they also have certain obligations toward one another. The law thus establishes the rules that define a person's rights and obligations. The law also sets penalties for people who violate these rules, and it states how government will enforce the rules and penalties. However, the laws enforced by government can be changed. In fact, laws frequently are changed to reflect changes in a society's needs and attitudes.

In most societies, various government bodies, especially police agencies and courts, see that the laws are obeyed. Because a person can be penalized for disobeying the law, most people agree that laws should be just. Justice is a moral standard that applies to all human conduct. The laws enforced by government have usually had a strong moral element, and so justice has generally been one of the law's guiding principles. But governments can, and sometimes do, enforce laws that many people believe to be unjust. If this belief becomes widespread, people may lose respect for the law and, in some cases, disobey it. However, in democratic societies, the law itself provides ways to amend or abolish these unjust laws.

This article discusses the main branches of law, the world's major legal systems, and the methods that democracies use to change their laws. The article also traces the development of law, examines current issues in United States law, and discusses law as a career. There are many separate *World Book* articles that provide detailed information on topics related to law. For a list of these articles, see the *Related articles* at the end of this article.

Branches of law

Law can be divided into two main branches: (1) private law and (2) public law. Private law deals with the rights and obligations people have in their relations with one another. Public law concerns the rights and obligations people have as members of society and as citizens. Both private law and public law can be subdivided into several branches. However, the various branches of private and public law are closely related, and in many cases, they overlap.

Private law is also called *civil law.* It determines a person's legal rights and obligations in many kinds of activities that involve other people. Such activities include everything from borrowing or lending money to buying a home or signing a job contract.

The great majority of lawyers and judges spend most of their time dealing with private law matters. Lawyers handle most of these matters out of court. But numerous situations arise in which a judge or jury must decide if a person's private law rights have been violated. These cases are called *lawsuits* or *civil suits.*

Private law can be divided into six major branches according to the kinds of legal rights and obligations involved. These branches are (1) contract and commercial law, (2) tort law, (3) property law, (4) inheritance law, (5) family law, and (6) corporation law. The dividing line between the various branches is not always clear, however. For example, many cases of property law also involve contract law.

Contract and commercial law deals with the rights and obligations of people who make contracts. A *contract* is an agreement between two or more persons that can be enforced by law. A wide variety of business activities depend on the use of contracts. A business firm makes contracts both with other firms, such as suppliers and transporters, and with private persons, such as customers and employees.

Tort law. A *tort* is a wrong or injury that a person suffers because of someone else's action. The action may cause bodily harm; damage a person's property, business, or reputation; or make unauthorized use of a person's property. The victim may sue the person or persons responsible. Tort law deals with the rights and obligations of the persons involved in such cases. Many torts are unintentional, such as damages in traffic accidents. But if a tort is deliberate and involves serious harm, it may be treated as a crime.

Property law governs the ownership and use of property. Property may be *real,* such as land and buildings, or *personal,* such as an automobile and clothing. The law ensures a person's right to own property as long as the owner uses the property lawfully. People also have the right to sell or lease their property and to buy or rent the property of others. Property law determines a person's rights and obligations in such dealings.

Inheritance law, or *succession law,* concerns the transfer of property upon the death of the owner. Nearly every country has basic inheritance laws, which list the relatives or other persons who have first rights of inheritance. But in most Western nations, people may will their property to persons other than those specified by law. In such cases, inheritance law also sets the rules for the making of wills.

Family law determines the legal rights and obligations of husbands and wives and of parents and children. It covers such matters as marriage, divorce, adoption, and child support.

Corporation law governs the formation and operation of business corporations. It deals mainly with the powers and obligations of management and the rights of stockholders. Corporation law is often classed together with contract and commercial law as *business law.*

Public law involves government directly. It defines a person's rights and obligations in relation to government. Public law also describes the various divisions of government and their powers.

Public law can be divided into four branches: (1) criminal law, (2) constitutional law, (3) administrative law, and (4) international law. In many cases, the branches of public law, like those of private law, overlap. For example, a violation of administrative law may also be a violation of criminal law.

Criminal law deals with crimes—that is, actions considered harmful to society. Crimes range in seriousness

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from disorderly conduct to murder. Criminal law defines these offenses and sets the rules for the arrest, the possible trial, and the punishment of offenders. Some crimes are also classed as torts because the victim may sue for damages under private law.

In the majority of countries, the central government makes most of the criminal laws. In the United States, each state, as well as the federal government, has its own set of criminal laws. However, the criminal laws of each state must protect the rights and freedoms guaranteed by federal constitutional law.

Constitutional law. A constitution is a set of rules and principles that define the powers of a government and the rights of the people. The principles outlined in a constitution form the basis of constitutional law. The law also includes official rulings on how the principles of a nation's constitution are to be interpreted and carried out.

Most nations have a written constitution. A major exception is the United Kingdom. The constitution of the United Kingdom is unwritten. It consists of all the documents and traditions that have contributed to the country's form of government. In most democracies, the national constitution takes first place over all other laws. In the United States, the federal Constitution has force over all state constitutions as well as over all other national and state laws.

Conflicts between a constitution and other laws are settled by constitutional law. In the United States, the courts have the power of *judicial review,* under which they may overturn any laws that are judged to be *unconstitutional.* A law is declared unconstitutional if the court determines that it violates the United States Constitution or a state constitution. The United States Supreme Court is the nation's highest court of judicial review.

Administrative law centers on the operations of government agencies. Administrative law ranks as one of the fastest-growing and most complicated branches of the law.

National, state or provincial, and local governments set up many *administrative agencies* to do the work of government. Some of these agencies regulate such activities as banking, communications, trade, and transportation. Others deal with such matters as education, public health, and taxation. Still other agencies administer social welfare programs, such as old age and unemployment insurance. In most cases, the agencies are established in the executive branch of government under powers granted by the legislature.

Administrative law consists chiefly of (1) the legal powers that are granted to administrative agencies by the legislature and (2) the rules that the agencies make to carry out their powers. Administrative law also includes court rulings in cases between the agencies and private citizens.

International law deals with the relationships among nations both in war and in peace. It concerns trade, communications, boundary disputes, methods of warfare, the uses of the ocean, and many other matters. Laws to regulate international relations have been developed over the centuries by customs and treaties.

International laws vary in the number of nations that accept them. Some rules are accepted by all nations as part of international law. These rules cover such items as the sanctity of treaties, the safety of foreign ambassadors, and each nation's jurisdiction over the air space above its territory. Other rules are accepted by the majority of countries, especially those that are most powerful. International law also includes agreements, such as trade treaties, between two or among a few nations.

The branches of law This table lists the major branches of private and public law and some of the legal matters they cover. A matter governed by one branch may also involve one or more other branches. For example, many cases of property law also concern contract law.

Private law

Contract and commercial law
- Credit purchases
- Employment contracts
- Guarantees
- Insurance policies
- Patents
- Promissory notes
- Sales contracts
- Subscriptions

Property law
- Landlord and tenant relations
- Mortgages
- Transfers of ownership
- Unclaimed property
- Intellectual property

Family law
- Adoption
- Annulment
- Divorce
- Marriage
- Child support

Tort law
- Invasion of privacy
- Personal injury
- Product liability
- Professional malpractice
- Slander and libel
- Traffic accidents
- Trespass
- Unfair competition

Inheritance law
- Estates
- Probate
- Trusts
- Wills

Corporation law
- Corporate finance
- Documents of incorporation
- Mergers and acquisitions

Public law

Criminal law
- Arson
- Bribery
- Burglary
- Extortion
- Forgery
- Kidnapping
- Larceny
- Manslaughter
- Murder
- Perjury
- Rape
- Robbery

Constitutional law
- Civil rights and liberties
- Federal and state powers
- Relations between the states
- Separation of executive, judicial, and legislative powers

Administrative law
- Communications and telecommunications
- Consumer protection
- Currency
- Environmental protection
- Interstate commerce
- Public safety
- Social welfare
- Taxation
- Workers' wages and hours

International law
- Arms control
- Extradition
- Hijacking and piracy
- Human rights
- Territorial waters
- Uses of outer space
- Uses of the ocean
- War crimes

There is no uniform way to enforce international laws. Laws within countries provide penalties for those who break them. But in the society of nations, no individual nation has the authority to punish other nations or to force them to submit their disagreements to court. The International Law Commission of the United Nations has given much study to improved ways of formulating and enforcing international law.

Systems of law

Every independent country has its own legal system. The systems vary according to each country's social traditions and form of government. But most systems can be classed as either (1) a *common law system* or (2) a *civil law system.* The United States, Canada, the United Kingdom, and other English-speaking countries have a common law system. Most other countries have a civil law system. Some countries combine features of both systems.

Common law systems are based largely on *case law*—that is, on court decisions. The common law system began in the United Kingdom hundreds of years ago. The system was called the *common law* because it applied throughout the land.

The common law developed from the rules and principles that judges traditionally followed in deciding court cases. Judges based their decisions on legal *precedents*—that is, on earlier court rulings in similar cases. But judges could expand precedents to make them suit particular cases. They could also *overrule* (reject) any precedents that they considered to be in error or outdated. In this way, judges changed many laws over the years. The common law thus came to be law made by judges.

However, some common law principles proved too precious to change. For example, a long line of hard-won precedents defended the rights and liberties of citizens against the unjust use of government power. The United Kingdom—and the other common law countries—have kept these principles almost unchanged. The United States, Canada, and other countries that were colonized by the United Kingdom based their national legal systems on the common law. In addition, every state in the United States except Louisiana and every Canadian province except Quebec adopted a common law system. Louisiana and Quebec were colonized by France and their legal systems are patterned after the French civil law system.

Case law is still important in common law countries. However, the lawmaking role of legislatures in these countries has increased greatly since 1900. For example, the United States Congress has made major changes in American contract and property law. The changes have dealt, for example, with such matters as labor-management relations, workers' wages and hours, health, safety, and environmental protection. Nevertheless, common law countries have kept the basic feature of the United Kingdom's legal system, which is the power of judges to make laws. In addition, constitutional law in these countries continues the common law tradition of defending the people's rights and liberties.

Civil law systems are based mainly on *statutes* (legislative acts). The majority of civil law countries have assembled their statutes into one or more carefully organized collections called *codes.*

Most modern law codes can be traced back to the famous code that was commissioned by the Roman Emperor Justinian I in the A.D. 500's. Justinian's code updated and summarized the whole of Roman law. It was called the *Corpus Juris Civilis,* meaning *Body of Civil Law.* For this reason, legal systems that are based on the Roman system of statute and code law are known as civil law systems. This use of the term *civil law* should not be confused with its use as an alternate term for private law. Civil law systems include both private law and public law.

In civil law countries, which include France and Mexico, the statutes, rather than the courts, provide the final answer to any question of law. Judges may refer to precedents in making their decisions, but they must base every decision on a particular statute and not on precedent alone.

Other systems. Many countries have patterned legal systems after both civil law and common law. For example, Japan and most Latin American nations have assembled all their private law into a code. But public law in these countries has been greatly influenced by common law principles, especially those that guarantee the rights and liberties of the people.

How laws are changed

Social conditions continually change, and so the law must also change or become outdated. Every nation changes its laws in the manner that its political system prescribes. In a dictatorship, only the top government leaders can change the law. Democracies, however, have developed four main methods of changing the law: (1) by court decision, (2) by legislation, (3) by administrative action, and (4) by direct action of the people.

By court decision. Judges in common law countries change many laws by expanding or overruling precedents. Especially in the United States, judges often overrule precedents to bring the law into line with changing social conditions. In 1896, for example, the U.S. Supreme Court upheld a law that provided for "separate but equal" public facilities for blacks and whites. But in 1954, the Supreme Court ruled that racial segregation in public schools is unconstitutional.

By legislation. Legislatures may change laws as well as make them. A legislature can change a statute by amending it, by *repealing* (canceling) it, or by passing a new law on the same subject. In most countries with a written constitution, some form of legislative action is required to amend the constitution.

By administrative action. Government agencies may be authorized to amend, repeal, or replace the regulations they make. In addition, they may be authorized to interpret old regulations to meet changing conditions.

By direct action of the people. Some national and many local governments give the people direct power to change the law by *referendum* or by *initiative.* In a referendum, a law or a proposed law is submitted to the voters for their approval or rejection. In an initiative, a group of citizens proposes a law, which is then approved or rejected by the legislature or by referendum. Many countries—and most states in the United States—have repealed their constitution one or more times and replaced it with a new one. In most such cases, the new

constitution cannot take effect until it has been approved by referendum.

The development of law

Civilized societies are so complex that they could not exist without a well-developed system of law. Scholars therefore conclude that people began to formulate laws in prehistoric times, even before the first civilizations arose. Prehistoric people had no system of writing, and so they left no record of their laws. The earliest laws were *customary* laws—that is, laws established by custom and handed down orally from one generation to the next.

The first civilizations and first systems of writing appeared between about 3500 and 3000 B.C. The invention of writing enabled people to assemble law codes. The development of written codes made the law a matter of public knowledge and so helped advance the rule of law in society. The first law codes were produced by ancient civilizations in the Middle East.

Early developments in the East. The first known law codes appeared in the ancient Middle Eastern land of Babylonia. A Babylonian king named Ur-Nammu assembled the earliest known code about 2100 B.C. Other Babylonian rulers produced codes during the following centuries. A king named Hammurabi drew up the most complete and best known of these codes during the 1700's B.C. Hammurabi's code, like the earlier ones, consisted mainly of a long list of rules to settle specific types of cases. The code laid down the law for such matters as the unfaithfulness of a wife, the theft of a farm animal, and the faulty work of a housebuilder. Many of the punishments were harsh by today's standards. For example, a son found guilty of striking his father had his hand cut off.

From about 1000 to 400 B.C., the Israelites of the Middle East assembled their religious and social laws into a code. The code reflected the teachings of Moses, a great Israelite leader of the 1200's B.C., and so it is often called the *Mosaic Code* or the *Law of Moses.* The Mosaic Code stressed moral principles. It became a key part of the first books of the Hebrew Bible and later of the Christian Bible. According to the Bible, the part of the code known as the *Ten Commandments* was given to Moses by God. The commandments therefore have had enormous influence on the moral content of the law in Western civilization.

By about 500 B.C., the civilizations of India and China had also produced codes of law. The codes in both countries stressed the moral obligations of the law. However, except for the religious laws of the Hebrew people, the legal traditions of Eastern civilizations have had little direct influence on today's major systems of law. Many Eastern peoples, even those influenced by Western traditions, still stress the moral obligations of the law. Accused persons have little opportunity to defend themselves.

Concern for the rights of an accused person—and for the rights of all citizens—developed mainly in Western civilization. But this development occurred slowly over many hundreds of years. Most scholars regard the ancient Greeks as the founders of both Western law and Western civilization.

The influence of ancient Greece. Unlike earlier civilizations, the civilization of ancient Greece made the law a clearly human institution. Before the Greeks, most people believed that only gods and goddesses had the power to make laws. The gods and goddesses gave the laws to certain chosen leaders. These leaders passed them on to the people. Like earlier peoples, the ancient Greeks believed that gods and goddesses required human beings to obey the law. But the Greeks also believed that human beings had the power to make laws—and to change them as needs arose. The Greek city-state of Athens became the chief center of this development.

A politician named Draco drew up Athens's first law code in 621 B.C. It became famous mainly for its harsh penalties for lawbreakers. In the 590's B.C., the ruling council of Athens authorized a high-ranking official named Solon to reform the city's legal and political system. Solon repealed most of Draco's stern code and drew up a much fairer code in its place. Solon also made the Athenian assembly more representative and increased its lawmaking powers.

In time, elected assemblies of citizens gained more and more legislative power in Athens. The Greeks thus began another key development of Western civilization—the founding of democratic government. However, as many as a third of the people of Athens were slaves. The Athenians, like other ancient peoples, denied slaves the legal rights of citizens.

The Greeks believed strongly in the importance of law. They considered respect for the law to be the mark of a good citizen. The great Athenian philosopher and teacher Socrates became the supreme example of this belief. A court sentenced Socrates to death in 399 B.C. for teaching Athenian youths to question the authority of the law. Socrates knew that he was innocent. But he accepted his sentence to show his respect for the law.

Ancient Roman law. Ancient law reached its peak under the Romans. Roman law included the same basic branches of public and private law that exist today. In fact, the scientific classification of the law began with the Romans. The Romans designed their laws not only to govern the people of Rome but also to build and hold together a vast empire. By the early A.D. 100's, the Roman Empire included much of Europe and the Middle East and most of northern Africa.

Early Roman times. The first known Roman law code, called the Laws of the Twelve Tables, was written about 450 B.C. It set down the chief customary laws of the Roman people in a form that was easy to remember. For hundreds of years, Roman boys had to memorize the code as part of their schoolwork.

The principles expressed in the Twelve Tables long remained the basis of Roman law. But the Romans gradually amended these principles to meet changing social conditions. After 367 B.C., a high public official called a *praetor* made the chief amendments. Each year, the praetor issued an *edict* (public order) that made any necessary changes. After 27 B.C., the Roman emperor could make or change laws as he wished. Eventually, the whole body of Roman law became extremely complex. The task of interpreting this great mass of laws fell to a group of highly skilled lawyers called *juris prudentes,* a Latin term for *experts in law.* Since that time, the science of law has been known as *jurisprudence.*

For many years, Romans and non-Romans within the

empire were governed under different sets of laws. Roman citizens were governed under the *jus civile* (civil law). The Romans developed a special set of laws, called the *jus gentium* (law of the nations), to rule the peoples they conquered. They based these laws on principles of justice that they believed applied to all people. Such principles are known as *natural law.*

Under Roman law, only Roman citizens could own property, make contracts and wills, and sue for damages. Slaves were not citizens, and so they had none of these rights. As the Romans developed the idea of natural law, however, they recognized that slaves also had human rights. Roman law thus began to require that slaves be treated fairly and decently.

Late Roman times. The belief in natural law also led to the idea that non-Romans within the empire should have the same rights as citizens. In A.D. 212, the Romans granted Roman citizenship to most of the peoples they had conquered, except slaves. The jus civile then became the law of the entire empire.

The principles of natural law set down in the jus gentium remained part of Roman law. These principles were important to future generations because they led to the belief in equal rights for all citizens. But hundreds of years passed before people fully developed the principles of equality that were outlined by the Romans. Once the principles had been developed, they contributed to the building of democratic governments in the United States, France, and many other countries.

Beginning with Julius Caesar, a long line of Roman rulers tried to organize all the empire's laws into an orderly code. Emperor Justinian I finally completed this task. Justinian's code, the famous *Corpus Juris Civilis* (Body of Civil Law), went into effect in 533 and 534. It covered the whole field of law so completely and so skillfully that it later became the model for the first modern law codes. Even today, the codes of most civil law countries are based on Roman law.

The Middle Ages. In 395, the Roman Empire split into two parts—the West Roman Empire and the East Roman, or Byzantine, Empire. The West Roman Empire, which had its capital in Rome, fell to invading Germanic tribes in the late 400's. The empire's fall marked the start of the 1,000-year period known as the Middle Ages. The East Roman Empire, which had its capital in Constantinople (now Istanbul), escaped the invasions. In 527, Justinian I became the ruler of the Eastern Empire, and his great code of Roman law was mainly enforced there.

In Western Europe, most of the legal and cultural institutions developed by the Romans gradually became overshadowed by other ones. However, Roman law survived in the West as the basis for *canon law*—the legal system developed by the Roman Catholic Church. Most Europeans during the Middle Ages were Catholics, and so canon law had a powerful influence on their lives.

The Germanic tribes that overthrew the West Roman

How laws have varied through the ages

Over the years, many identical matters of law have been treated differently. This table shows how several such matters have been treated (1) in the code of Roman law issued by Justinian I in A.D. 533-534; (2) in England in the late Middle Ages; and (3) in the United States today.

Legal matter	Code of Justinian	English law in the late Middle Ages	Modern U.S. law
Actions punished by death	Rape, treason, and certain cases of embezzlement, forgery, and kidnapping. Murder was punished by banishment.	Any action classed as a serious crime, including arson, burglary, counterfeiting, murder, rape, robbery, and treason.	Many states have banned the death penalty. The states that have the penalty use it to punish convicted murderers.
Theft	Not treated as a crime. The victim could sue the thief and receive up to four times the value of the stolen property.	A crime punished by fine, imprisonment, branding, whipping, or death.	A crime punished by a fine or a jail or prison sentence—or by both a fine and a sentence.
Failure to pay a debt	Early Roman law allowed a creditor to sell a debtor into slavery. The Code of Justinian required a creditor to sue to recover a debt.	A creditor could seize a debtor's property and have the person imprisoned.	A creditor must sue to recover a debt.
Inheritance	Estate divided equally among the children. Wives could not inherit, unless provided by will.	Estate went automatically to the oldest son. Wives could not inherit the estate, but they received a share of its income.	Estate divided in varying proportions between surviving husband or wife and surviving children, unless otherwise directed by will.
Rights of women	Both married and unmarried women could own property, make contracts and wills, and sue for damages.	Unmarried women had most of the same legal rights as men. Married women needed their husband's consent to own property, to make contracts and wills, and to sue or be sued. They could not be accused of a crime. A woman's husband was normally held responsible for any crimes she committed.	Both married and unmarried women have nearly the same legal rights as men.

Empire had their own law codes, which they introduced into the regions they conquered. But these codes were undeveloped compared with Roman law. They consisted chiefly of long lists of fines for specific offenses, such as stealing a neighbor's ox or dog.

By the 800's, Europeans had developed a political and military system known as *feudalism.* Under feudalism, people owed allegiance to individual lords rather than to a central government. A lord enforced the law in his territory and granted protection to the people who served in his armies and who lived and worked on his land. The legal system of the Middle Ages was largely based on this relationship between lords and the people who depended on them.

In particular, feudal law spelled out the duties that people owed to their lord. But a lord could not demand more than the law allowed. The people thus had a right to refuse any demands by their lord that went beyond the limits of the law. Europeans later used this principle to resist monarchs who claimed too much power. The principle thus played an important role in the struggle for democracy in Europe.

Feudal law remained the basic law in Western Europe until about 1300. By then, Western Europeans had begun to establish improved legal systems. However, this development differed greatly between the countries of mainland Europe and the island country of England.

Developments in mainland Europe. The economy of Western Europe began to grow rapidly during the 1000's. As commerce and industry increased, they created a need for a set of laws that was more complex and varied than feudal law. Scholars believed that ancient Roman law could meet this need. Beginning about 1100, the University of Bologna in northern Italy trained law students from many parts of Europe in the principles of the Corpus Juris Civilis. Interest in the code soon spread to other European universities. Roman law thus gradually began to replace feudal law in mainland Europe.

Developments in England. England already had a strong, unified legal system by the 1200's, when Roman law was beginning to spread across Europe. As a result, England did not adopt the Roman system.

England's legal system had grown out of the country's courts. English courts had long based their decisions on the customs of the English people. But customs varied from district to district. As a result, similar cases were often judged differently in different districts. In the early 1100's, however, strong English kings began to set up a nationwide system of royal courts. Judges in these courts applied the same rulings in all similar cases. In this way, the courts soon established a body of *common law*—that is, law which applied equally anywhere in England. Judges could change the law as the nation's needs and customs changed, but any change applied in all common law courts.

As English common law developed over the years, it established many precedents that limited the powers of government and protected the rights of the people. These precedents made even the monarch subject to the law. The common law thus assisted the growth of democracy in England.

The right known as *habeas corpus* was one of the chief common law safeguards of personal freedom. *Habeas corpus* is a Latin term meaning *you are ordered to have the body.* As developed in English common law, habeas corpus means that a person cannot be held in prison without the consent of the courts. The Founding Fathers of the United States considered this right so essential to human liberty that they wrote it into the Constitution (Article I, Section 9).

The first modern law codes. Roman law had been adopted throughout most of Europe by the end of the 1500's. But only England had a monarchy strong enough to establish a unified legal system. In other countries, law codes were drawn up and enforced mainly by local governments. These local codes differed greatly from one part of a country to another. Beginning in the 1500's, many European monarchs set out to form strong central governments. To help achieve this goal, they began to assemble the assorted local codes of their countries into national codes—a development called the *codification movement.*



Illuminated manuscript (about 1450) by an unknown English artist; Granger Collection

The King's Bench was England's chief criminal court during the late Middle Ages. It helped establish the nation's *common law*—that is, a uniform body of law that applied throughout England. In this picture, chained prisoners, *bottom,* await their turn to be tried before judges, *top.*

The codification movement reached its peak under the French ruler Napoleon Bonaparte. In 1800, Napoleon appointed a committee of legal scholars to turn the whole of French private law into a compact, well-reasoned code. The new code, called the *Code Civil* or *Code Napoléon,* was a skillful blend of Roman law, French customs, and democratic philosophy. It went into effect in 1804, along with several other codes that covered other areas of law, and has remained France's basic code of private law ever since. It has also been a model for the private law codes of most civil law countries. Thus, Roman law, as contained in the Code Napoléon, still influences people's lives.

Beginnings of U.S. law. When the American colonists declared their independence from England in 1776, they based their claims partly on the ancient Greek and Roman ideas of natural law. These ideas had been developed in detail by various French philosophers of the 1700's, such as Claude Helvétius and Jean-Jacques Rousseau. The French had especially promoted the idea that the natural law gives all people equal rights. The U.S. Declaration of Independence echoed this idea in the famous phrase "... all men are created equal [and] are endowed by their Creator with certain unalienable Rights."

The American colonists also based their claims for independence on common law principles. The English settlers who established the American Colonies had brought these principles with them. Moreover, many of the leaders in the colonies' struggle for independence were lawyers who had been trained in the common law. These men were especially dedicated to the common law principles that put the rights of the people above the will of a monarch. The common law thus became a driving force behind the writing of the Declaration of Independence. Common law principles also influenced the development of the U.S. Constitution and the Bill of Rights.

Constitutional law. American courts had the same power to make laws that English courts had. A series of U.S. Supreme Court decisions in the early 1800's strengthened this power. The court's decision in 1803 in the case of *Marbury v. Madison* was especially important. In this decision, the court declared a federal law unconstitutional for the first time. The principle of judicial review was thus firmly established, enabling U.S. courts to overturn laws they judged unconstitutional.

Other branches of law. The U.S. legal system adopted the basic ideas, but not the whole body, of English common law. Many parts of the common law were impractical for the new, rapidly expanding nation of the United States. English property law was particularly unsuited. Land was scarce in England, and so the law heavily restricted the transfer of land from one owner to another. But much of the land in the United States was unsettled, and the nation was constantly expanding its frontiers. To ensure the nation's growth, people had to be free to buy and sell land. American property law therefore began to stress the rights and obligations involved in land transfers. The English laws that restricted such transfers were discarded.

Contract law became more important in the new nation than it had been in England. By the early 1800's, Americans had begun to develop a flourishing economy based almost entirely on free enterprise. In a free enterprise system, business people regulate their dealings largely by contract. The rapid growth of the U.S. economy in the 1800's therefore brought an enormous increase in contract law. The law especially emphasized freedom of contract, with no government interference. This emphasis lasted into the 1900's. In 1905, in the case of *Lochner v. New York,* the Supreme Court upheld the right of employer and employee to contract for working hours free from government control.

The development of Canadian law. Canada's legal history dates from the legal system established by the first French settlers in the 1600's. The French set up a civil law system in the areas they colonized, including what is now the province of Quebec. They based their system on one of the major local law codes in France—a code known as the *Custom of Paris.*

Britain gained control of France's Canadian possessions in 1763 and introduced a common law system. But French Canadians objected to giving up their legal traditions. In 1774, the British Parliament passed the Quebec Act, which allowed French Canadians to follow their traditional system in private law matters. The common law, however, remained the basis of all other law in Canada. In 1866, Quebec adopted a private law code based on the Code Napoléon.

The British North America Act, passed by the British Parliament in 1867, created the Dominion of Canada. The act gave Canada limited self-government and provided a constitutional framework for the new Canadian federal government. The federal legal system was based on the common law. Each province could keep its traditional legal system except in matters of public law. All the provinces except Quebec based their legal system on the common law. Quebec kept its civil law system in matters of private law. Canada's Parliament was authorized to set up the nation's criminal law system.

Law since 1900. During the 1800's, Western systems of law spread throughout the world. Many countries, for example, adopted private law codes patterned after the Code Napoléon. The U.S. Constitution influenced the making of written constitutions in many countries. The main systems of law—that is, the civil and common law systems—have remained basically unchanged since 1900. However, the role of the law has undergone dramatic changes in nearly every country.

Freedom of contract was the key doctrine of private law in many countries until the 1900's. By then, many businesses were using this freedom to increase their profits at the expense of their employees, stockholders, and customers. For example, factory owners claimed that efforts to protect the rights of workers interfered with the owners' rights to contract freely with their employees. Many employees had to accept unfavorable contracts or lose their jobs.

Before 1900, the idea that law should interfere with private business as little as possible was widely accepted. Since then, however, the public's attitude toward the law has changed greatly. Today, most people believe that the private interests of some members of society should not deprive other members of society of their rights. Legislation and court decisions in the United States and other countries have reflected this belief, especially by stressing the social aspects of contract law.

For example, the U.S. Congress and the state legislatures have passed many laws to help ensure the fairness of employment contracts. Some of these laws regulate working conditions and workers' wages and hours. Other laws guarantee the right of workers to organize and to strike.

Legislation and court decisions have also changed many features of property, tort, and family law in many countries since 1900. The social obligations of property owners have been enforced by zoning laws and by laws prohibiting environmental pollution. During the 1800's, tort law typically held that a person could collect for an injury only if another person could be proved at fault. But the development of private and public insurance programs during the 1900's helped establish that a person should be paid for accidental injuries regardless of who was at fault. This "no fault" principle has made it unnecessary to sue for damages in certain cases. Many changes in family law during the 1900's reduced the legal rights of husbands over their wives and of fathers over their children. The law thus placed increased emphasis on women's and children's rights.

During the mid-1900's, the United States and other countries gave increased attention to the field of civil rights. For instance, during the 1950's and 1960's, the U.S. Supreme Court used the power of judicial review to strike down a variety of state and local laws that supported racial segregation. The court based these decisions on the 14th Amendment to the Constitution, which guarantees equal protection under the law. Since 1970, the court has also used this amendment to help ensure fair and equal treatment for women, aliens, poor people, and persons accused of crime.

Developments in international law. During the 1900's, international law became increasingly important. After World War I ended in 1918, the governments of 32 nations drew up a peace settlement that led to the establishment of the League of Nations. The goal of the League of Nations was to prevent war and uphold international law. In 1920, the League set up the Permanent Court of International Justice. From 1928 to 1934, more than 60 nations signed the Kellogg-Briand Pact, under which they agreed not to use war to achieve their goals. However, both the League of Nations and the Kellogg-Briand Pact were largely unsuccessful in upholding international law.

Shortly after World War II ended in 1945, the United Nations (UN) was formed to work for world peace and security. The trials of German and Japanese leaders at Nuremberg and Tokyo after World War II were an important step in the development of international law. Some of the leaders were charged not only with breaking the laws of war, but also with bringing about the war itself. In the 1990's, the UN began conducting trials of people accused of committing *war crimes*—that is, violations of the rules of war—in civil wars in Rwanda and in the lands that had been part of Yugoslavia.

Many other international organizations and agreements have shaped international law overseeing various economic, cultural, and social concerns. These agreements and organizations include the North American Free Trade Agreement (NAFTA) and the Association of Southeast Asian Nations (ASEAN). NAFTA unites Canada, Mexico, and the United States in one of the world's largest free-trade zones. ASEAN works for peace and stability among the countries of Southeast Asia.

Current issues in U.S. law

The problem of too many laws. Congress and the state legislatures pass thousands of laws each year. These laws are added to the hundreds of volumes of federal and state statutes already in force. The regulations issued by federal and state agencies also accumulate at a rapid rate.

As the number of laws has grown, the whole body of law has become more difficult to administer. In addition, the law has become so complex that people cannot possibly know how it affects them in every case. A nation can make its laws simpler by organizing them into a uniform code. But common law traditions are so strong in the United States that all efforts to codify the nation's private laws have failed.

The enormous number of laws issued each year raises the question of whether society expects too much of the law. Many people believe that nearly every need and want of society can be met simply by "passing a law." This belief has led legislatures and the courts to make more laws to satisfy not only society's demands but also the demands of small, special-interest groups. However, there are limits to what the law can do. If the law tries to satisfy every demand, it can easily fail. People may then begin to doubt that the law can do anything at all. In addition, people tend to resent laws that interfere in their private affairs. But as the number of laws grows, more and more aspects of life become regulated.

The question of who should make laws. The common law as developed in England enables the courts to make laws. However, American courts have expanded their powers far beyond the English idea to bring about revolutionary social changes, especially in the field of civil rights. Some of these changes have been unpopular with many Americans. But through the power of judicial review, the courts can overrule the wishes of even the vast majority of the people.

Many experts believe that questions of great social importance should be settled by legislation rather than by decisions reached in courts. They point out that democratic government depends on the freedom of the legislature to reflect the will of the people. If the courts block this freedom, democracy may be seriously weakened. Other experts believe that the courts must defend the constitutional rights of every American regardless of popular support.

The right to legal assistance. As the law has grown more complex, the demand for professional legal services has increased. As a result, even the most routine services, such as drawing up contracts and wills, have become more costly. Large corporations and wealthy people generally can afford all the legal help they need.

Since the early 1960's, court decisions and legislation have ensured legal help for criminal defendants too poor to hire a lawyer. In addition, public and private legal aid services provide poor people with free counsel in private law cases. Still, many poor people do not know they have a right to these services, and so they do not benefit from them.

Millions of middle-income Americans have great difficulty getting professional legal help when they need it.


John Marshall Law School of Chicago (WORLD BOOK photo by Dan Miller)

A law school competition called a *moot court* tests the ability of law students to argue court cases. In a moot court session, two teams of students take opposing sides in an imaginary case. A panel of lawyers or student lawyers decides which contestants have presented the most convincing arguments.

These people cannot afford to hire a lawyer. Yet they do not qualify for the free legal services available to the poor. To help remedy this problem, some lawyers in large cities have set up *legal clinics.* The clinics provide middle-income families with routine legal services at reduced rates.

Social obligations and individual rights. Court decisions and legislation have increasingly stressed the social aspects of the law in the United States. More and more laws have thus been made to ensure equality for all Americans and to protect the economic and environmental interests of society. To achieve these goals, the law has had to limit many of the rights traditionally granted to individuals under private law. Property rights and freedom of contract, in particular, have been heavily restricted—a matter of concern to many Americans.

Most experts believe, however, that the social trend of the law will continue. In that case, the rights and freedoms of individuals under private law will become even more restricted. Legislatures and courts therefore face an enormous challenge. On the one hand, they must formulate laws to meet the needs of a complex and rapidly changing society. On the other hand, they must also be careful that these laws do not so restrict property rights as to hinder free enterprise.

A career as a lawyer

In most countries today, a person must be trained and licensed to practice law. However, the training and licensing of lawyers vary greatly from country to country. In the civil law countries of Western Europe, Japan, and elsewhere, students study law as undergraduates and then apply for further specialized legal study at a national legal research institute. These institutes provide training and apprenticeships in specific areas of law. By contrast, legal education in the United States takes place at law schools, where students receive a more general training in all areas of law. This section deals with law as a career in the United States.

Law education. To practice law in most states of the United States, a person must first have a degree from a law school. The majority of law schools are a part of large universities. A few are independent institutions. Most U.S. law schools admit only four-year college graduates. During their college training, *prelaw* students do not have to take any particular courses. But the majority of students planning to go to law school specialize in the humanities or the social sciences.

Most law school programs require three years of study. During this time, students take courses in all the major branches of public and private law. Upon completing the program, a student receives a J.D. (Doctor of Jurisprudence) degree. In general, law schools at state universities in the United States have the lowest tuition fees, and private institutions require the highest.

The first U.S. institution devoted entirely to the teaching of law operated in Litchfield, Connecticut, from 1774 to 1833. The first law professorship in the United States was established in 1779 at the College of William and Mary. Harvard University established the nation's first university law school in 1817. Between 1830 and 1860, law schools were founded at other U.S. universities, including Columbia University, the University of Michigan, New York University, Northwestern University, the University of Pennsylvania, and Yale University.

All the early law schools used traditional teaching methods. Students attended lectures and studied standard textbooks. During the 1870's, a new method of teaching law, the *case method,* was developed at Harvard University. This method trained students in precise legal reasoning through the reading, analysis, and discussion of actual court cases. Today, almost all U.S. law schools use the case method.

Law school standards have been steadily raised in the United States since the mid-1800's, largely through the work of the American Bar Association (ABA) and the Association of American Law Schools (AALS). The ABA is a private, nationwide organization of lawyers that was founded in 1878. The AALS was founded in 1900 by 35 of the about 100 U.S. law schools that were then in existence. Both organizations have continually raised the minimum educational standards that a law school must

meet to gain their approval. Today, the United States has about 220 law schools. About 175 of them are approved by either the ABA or the AALS or by both organizations.

In the past, nearly all law students were men. But the number of women law students has been steadily increasing. Today, women make up about half the total enrollment in the major U.S. law schools.

Licensing of lawyers. Each state has its own bar—that is, the body of lawyers who have a license to practice in the state. The word *bar* originally referred to the railing or partition that traditionally separates spectators from the proceedings in a courtroom. Lawyers represent their clients *before the bar* rather than from the spectator area in the back of the courtroom. Because of the lawyer's position in the courtroom, the whole body of lawyers became known as the *bar.*

Most states issue a license to law school graduates who pass the state's *bar examination.* A few states automatically license graduates of approved law schools in the state, without a bar examination. The highest court or the legislature in each state sets rules of conduct for lawyers. The court has the power to *disbar* (suspend from practice) any member of the state bar who violates these rules.

The practice of law. The majority of U.S. lawyers conduct most of their business out of court. But some lawyers, particularly those who specialize in criminal cases, do much trial work.

Many American lawyers have a general practice. They provide every kind of legal service, from drawing up wills and other legal papers to handling court cases. Other lawyers—especially in big cities—concentrate on a particular branch of the law, such as corporation law or administrative law. Some of these lawyers work for large law firms. Such firms provide clients with specialized services in one or more branches of the law. Most large business corporations employ experts in corporation law.

Some large law firms have therefore begun to employ specially trained persons called *lawyer's assistants.* A lawyer's assistant does *paralegal work*—that is, routine legal tasks under a lawyer's supervision. Lawyers who employ such assistants can devote more time to complex legal cases.

The law has long been one of the most common roads to public office. Congress, the state legislatures, and the administrative agencies have attracted more people from the law than from any other profession. Almost all judges have been lawyers, and such public officials as district attorneys and prosecutors must be lawyers. About two-thirds of all of the presidents of the United States were lawyers. Further information on careers in the law can be obtained by contacting the American Bar Association, which has its headquarters in Chicago.

David M. O'Brien

Related articles. See the *Government* section of the various state, province, and country articles, such as **Alabama** (Government); **Alberta** (Government); **Argentina** (Government). See also the following articles:

Branches of private law

Business law

Agent
Antitrust laws
Attachment
Bankruptcy
Bill
Bill of exchange
Blue-sky laws
Bond
Check
Common carrier
Conglomerate
Contract
Copyright
Corporation
Credit
Debt
Draft
Garnishment
Guaranty
Interest
I.O.U.
Joint-stock company
Legal tender
Limited company
Loan company
Moratorium
Negotiable instrument
Note
Partnership
Patent
Pawnbroker
Power of attorney
Rebate
Receiver
Stock, Capital
Trademark
Usury

Tort law

Assault and battery
Damages
Libel
Malpractice suit
Negligence
Product liability suit
Slander
Tort
Trespass

Property law

Abandonment
Air rights
Appraisal
Assignment
Bill of sale
Deed
Eminent domain
Escrow
Eviction
Fee
Fixture
Intellectual property
Joint tenancy
Lease
Lien
Mortgage
Occupancy
Personal property
Property
Real estate
Squatter
Tenant
Title
Torrens system

Inheritance law

Administrator
Dower
Escheat
Estate
Executor
Heir
Legacy
Living will
Next of kin
Probate
Will

Family law

Abandonment
Adoption
Alienation of affections
Alimony
Breach of promise
Community property
Desertion
Divorce
Dower
Family (Home life)
Guardian
Marriage
Ward

Branches of public law

Criminal law

Abandonment
Arson
Assassination
Assault and battery
Bigamy
Blackmail
Breach of the peace
Bribery
Burglary
Conspiracy
Contempt
Counterfeiting
Crime
Embezzlement
Euthanasia
Extortion
False imprisonment
Felony
Forgery
Fraud
Hate crime
Homicide
Juvenile delinquency
Kidnapping
Larceny
Libel
Lynching
Manslaughter
Mayhem
Misdemeanor
Murder
Perjury
Polygamy
Racketeering
Riot
Robbery
Sabotage
Slander
Smuggling
Treason
Trespass
Vagrancy
Vandalism

Constitutional law

Articles of Confederation
Bill of rights
British North America Act
Canada, Government of (The Constitution)
Citizenship
Civil rights
Constitution
Constitution of the United States
Due process of law
Enabling act
Freedom of assembly
Freedom of religion
Freedom of speech
Freedom of the press
Magna Carta

Petition of Right
Sexual harassment
States' rights
Supreme Court of the United States (table: Landmark decisions)
United Kingdom (The Constitution)

Administrative law

See the following articles and their lists of *Related articles:* Local government; State government; Taxation; United States, Government of the; and Canada, Government of.

International law

See International law and its list of *Related articles.*

Lawmaking

Amendment
Canada, Government of (How a bill becomes law in Canada)
Cloture
Code
Common law
Congress of the United States
Duma
Executive order
Filibustering
House of Burgesses
House of Commons
House of Lords
House of Representatives
Judicial review
Legislature
Lobbying
Parliament
Repeal
Senate
United States, Government of the (How a bill becomes law in the United States)
Veto

Legal procedures and terms

Affidavit
Appeal
Attainder
Autopsy
Bail
Brief
Confession
Deposition
Equity
Evidence
Grand jury
Grandfather clause
Habeas corpus
Incompetence
Indictment
Injunction
Inquest
Judgment
Jury
Mandamus
Minor
Oath
Petition
Plea bargaining
Restraining order
Statute of limitations
Subpoena
Suit
Summons
Trial
Witness
Writ
Writ of assistance

Law enforcement

See the following articles and their lists of *Related articles:* Court; Crime; Law enforcement; and Police.

History

Code Napoléon
Draco
Feudalism
Hammurabi
Inns of Court
Justinian Code
Lycurgus
Moses
Plato
Solon
Star Chamber
Ten Commandments
Trial by combat
Twelve Tables, Laws of the

Other related articles

American Bar Association
Case method
Civil disobedience
Civil law
Class action
Criminal justice system
Ethics
Fiat
Franchise
Impeachment
Independent counsel
Justice, Department of
Law Day U.S.A.
Lawyer
Legal aid
License
Maritime law
Martial law
Parliamentary procedure
Public opinion

Outline

I. Branches of law
A. Private law
B. Public law

II. Systems of law
A. Common law systems
B. Civil law systems
C. Other systems

III. How laws are changed
A. By court decision
B. By legislation
C. By administrative action
D. By direct action of the people

IV. The development of law

V. Current issues in U.S. law
A. The problem of too many laws
B. The question of who should make laws
C. The right to legal assistance
D. Social obligations and individual rights

VI. A career as a lawyer
A. Law education
B. Licensing of lawyers
C. The practice of law

Questions

What kind of legal system do English-speaking countries have? How did it develop?
How did the ancient Greeks make the law a clearly human institution?
What method do almost all U.S. law schools use in teaching law?
What are the two main branches of the law?
How did the common law become a driving force behind the writing of the Declaration of Independence?
How have legislation and court decisions during the 1900's changed contract law in the United States?
What is *judicial review*? What part has it played in the field of civil rights in the United States?
What are the four main methods of changing the law in democratic countries?

Additional resources

Bessette, Joseph M., ed. *American Justice.* 3 vols. Salem Pr., 1996.
Feinman, Jay M. *Law 101: Everything You Need to Know About the American Legal System.* Oxford, 2000.
Knight, Alfred H. *The Life of the Law: The People and Cases That Have Shaped Our Society, from King Alfred to Rodney King.* 1996. Reprint. Oxford, 1998.

Law, Andrew Bonar (1858-1923), a British statesman, was prime minister in 1922 and 1923. He entered Parliament in 1900. He became the Conservative Party leader in 1911. In December 1916, Law refused the king's offer to try to form a new cabinet, and served under Prime Minister David Lloyd George as chancellor of the Exchequer. In 1922, Law and other Conservatives forced Lloyd George to resign. Law was born on Sept. 16, 1858, in New Brunswick, Canada. He moved to Scotland at the age of 12. Keith Robbins

Law, Bernard Francis Cardinal (1931-), was appointed a cardinal of the Roman Catholic Church by Pope John Paul II in 1985. The pope had named Law archbishop of Boston in 1984. Law had previously served as bishop of the diocese of Springfield-Cape Girardeau, Missouri.

Law was born on Nov. 4, 1931, in Torreón, Mexico, to American parents. He was ordained a priest in 1961. He served as a parish priest in Vicksburg, Mississippi, from 1961 until 1963, when he became editor of the diocesan newspaper of Jackson, Mississippi. In 1968, Law became executive director of the Committee on Ecumenical and Interreligious Affairs, a group sponsored by the National Conference of Catholic Bishops. He was appointed vicar-general of the Natchez-Jackson, Mississippi, diocese (now the Jackson diocese) in 1971, and bishop of the Springfield-Cape Girardeau diocese in 1973.

Kenneth Guentert

Law, John (1671-1729), a Scottish financier and gambler, tried to revive the French economy by opening a

bank in 1716 to issue paper money. His plans also included land speculation and trade in Louisiana, which became famous as the *Mississippi Scheme.*

Law was born on April 21, 1671, in Edinburgh. In 1694, he killed a man in a duel. Law was arrested and sentenced to death. However, he escaped from prison and fled to Amsterdam, capital of the Netherlands. There he studied the operations of the Bank of Amsterdam. He then accumulated a large fortune through gambling.

Law opened a bank in France in 1716. The paper money issued by the bank soon became readily acceptable. In 1717, Law established a company which soon monopolized trade with nearly all French possessions. In 1718, the bank became the Royal Bank.

Law's bank issued excessive quantities of paper money. Much of it was used to speculate in stock issued by his trading company. Speculators soon demanded gold for their paper money. The whole project collapsed, leaving thousands of people bankrupt in the panic that followed (see Mississippi Scheme). John B. McFerrin

Law Day U.S.A. is celebrated throughout the United States on May 1 to emphasize the importance of law in American life. The American Bar Association and state and local bar associations sponsor Law Day U.S.A. Many schools, courts, churches, and organizations hold special programs on Law Day U.S.A. These programs include naturalization ceremonies for new citizens, mock trials, and courthouse tours. President Dwight D. Eisenhower proclaimed the first Law Day in 1958.

Critically reviewed by the American Bar Association

Law enforcement is the means by which a community, state, or country keeps order. The enforcement of civil and criminal law by government agencies helps the members of a society to live together peaceably.

Civil law regulates many conflicts between people. Disputes about such matters as contracts, ownership of property, and payment for personal injury are settled in court through lawsuits. The enforcement of civil law takes up most of the time of most lawyers and courts, but it does not involve the police.

Criminal law covers actions harmful to society. Such crimes as murder, rape, and robbery threaten the order of a society. This article discusses the enforcement of criminal law. People who violate criminal law may be (1) arrested by the police and (2) put on trial by the local, state, or national government. If found guilty, they may be (3) imprisoned.

Arrest. Police enforce criminal law by arresting anyone they reasonably believe has committed a crime. In some cases, a police officer must have a court order called a *warrant* before making an arrest. But an officer does not need a warrant to arrest a person he or she observes violating the law. Many people who go on trial were arrested without a warrant shortly after the crime of which they were accused.

Trial. The evidence that a person committed a crime is given by the police to a government attorney called a *prosecutor.* At a *preliminary hearing* held before a judge, the prosecutor must show "probable cause" to justify holding the defendant for trial. The judge appoints a defense attorney to handle the person's case if the accused cannot afford to hire one. The judge sets bail if he or she believes the defendant should go on trial. A defendant who does not have enough money to put up bail must stay in jail until the trial.

Formal charges against the defendant may be made in the form of an *information* by the prosecutor or as an *indictment* by a grand jury. In many cases, the accused agrees to plead guilty in exchange for being charged with a less serious crime or being promised a shorter prison sentence. This process is called *plea bargaining.* The judge takes the plea at a hearing called an *arraignment.* About 90 percent of all defendants plead guilty, most of them as a result of plea bargaining.

Defendants who plead not guilty may have a trial by jury, or the judge alone may decide the facts of the case. If the defendant is found guilty, the judge then sentences the individual.

Imprisonment. Most criminal laws specify the longest and shortest prison term to which an offender may be sentenced. The judge often decides the exact length of the sentence, depending on what he or she feels will best serve both the offender and society. Prison terms are meant to punish offenders, reform criminals, remove dangerous offenders from society, and show possible future lawbreakers the penalties for crime.

If the judge believes a prison term would not help an offender, the individual may be sentenced to a period of probation. A lawbreaker who is on probation remains free, but a probation officer assigned by the court may check on the individual's activities. An offender who violates the rules of the probation may be imprisoned.

Donald O. Schultz

Related articles in *World Book* include:

Arrest	Law
Bail	Parole
Breath testing	Plea bargaining
Civil law	Police
Court	Prison
Criminal justice system	Racial profiling
Hypnotism (Uses of hypnotism)	Restraining order
Indictment	Sentence
Interpol	Trial
Jury	Warrant

Law of the Sea Convention is an international agreement that establishes nations' rights and obligations regarding the ocean. For example, it specifies how far a country's borders may extend beyond its shoreline. It also seeks to regulate mining at the bottom of the ocean. The treaty's official name is the United Nations Convention on the Law of the Sea. It is sometimes referred to as UNCLOS.

The United Nations sponsored the treaty, which took effect in 1994 after 60 nations ratified it. The agreement applies only to nations that have officially consented to its terms. The United States and Canada have not ratified the treaty.

The treaty specifies that a nation's territorial waters extend only 12 nautical miles (22 kilometers) from its shore. Within these waters, a nation can completely control natural resources and the passage of ships, though foreign ships must be allowed passage for peaceful purposes.

Some countries that have not signed the treaty claim territorial rights up to 200 nautical miles (370 kilometers) offshore. The treaty grants most coastal nations a 200-nautical-mile *exclusive economic zone,* where the country has sole rights to all natural resources, including fish.

Ocean areas not covered by the treaty are called the *high seas* or *international waters* and lie outside the authority of any nation (see **High seas**). The treaty also requires that important straits remain open for the free use of all ships.

The treaty seeks to fairly distribute the minerals that lie on or below the ocean floor in international waters. The pact treats the minerals as "the common heritage of mankind." However, only a few nations have the technological ability to mine them. For this reason, the treaty requires any country or company that wishes to mine the seabed in international waters to identify two promising sites.

An organization set up by the treaty, called the International Seabed Authority, would help develop one of the two sites. The country or company could mine the other one independently. The benefits or profits from the International Seabed Authority's activities would be distributed internationally, in part to the world's less technologically developed countries. The treaty also requires nations to guard against ocean pollution from seabed mining, offshore oil wells, land-based sources, and vessels at sea. William B. Vogele

Lawless, Theodore Kenneth (1892-1971), an African American physician, became known for his work in the field of dermatology. He helped develop treatments for *lesions* (skin changes) resulting from the use of arsenic in the treatment of syphilis. Lawless also was a successful businessman and worked actively for many civic organizations.

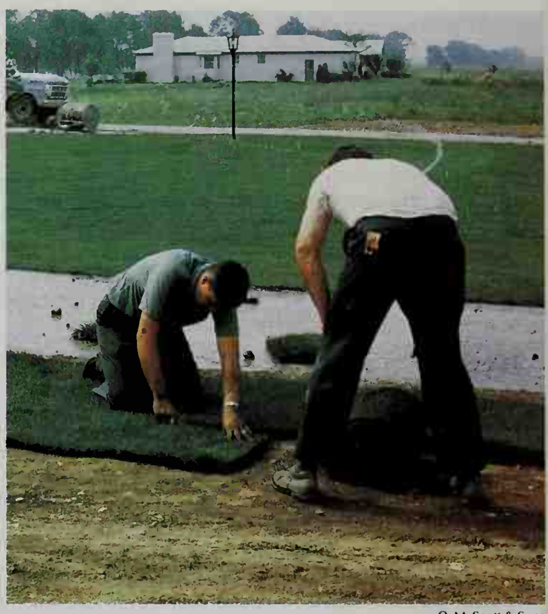
Lawless was born in on Dec. 6, 1892, in Thibodaux, Louisiana. He received his medical degree from Northwestern University. He did postgraduate study at Massachusetts General Hospital in Boston, and also at hospitals in Europe. He taught dermatology at Northwestern from 1924 to 1941. In 1954, Lawless was awarded the Spingarn Medal, the highest honor given by the National Association for the Advancement of Colored People.

Dale C. Smith

Lawmaking. See **Legislature; United States, Government of the** (How a bill becomes law in the United States); **Canada, Government of** (How a bill becomes law in Canada); **Congress of the United States.**

Lawn is an area or plot of ground that has a thick covering of closely cut grass. A lawn may surround a home or apartment building, or it may form part of the landscape around a public building. Lawns also serve as recreation areas in parks and playgrounds.

People grow lawns for several reasons. Lawns beautify the surroundings and help prevent soil erosion. In hot weather, they cool the air near the earth's surface. They also reduce noise pollution by absorbing sound.



O. M. Scott & Sons

Sodding is one of the three ways of planting grass. In this method, sections of soil already covered with grass are laid on the ground. Sodding is used to quickly cover an area with grass.

Growing a lawn

A successful lawn should grow evenly, and its color and texture should both be uniform throughout. Before starting a lawn, be sure the site is well drained and fairly smooth. It may be uneven but should have no steep slopes. Next, follow certain steps in preparing the soil and planting the grass.

Preparing the soil. Plan to prepare the soil at least a week before planting the grass. First, grade the site by removing all topsoil. A small tractor with a special blade attached may be used for a large area. Such a tractor can be rented from a garden supply center. Or, you may use a hoe, a rake, a shovel, a spade, or some other gardening tool to remove the topsoil. Be sure to pile up the topsoil as it is removed. It will later be used to cover the subsoil that is exposed during the grading process. In addition, be sure to remove any debris, such as rocks, sticks, and clods of dirt.

After grading the lawn site, replace the topsoil. To make sure the topsoil has the needed *nutrients* (nourishing substances), add a layer of organic material. The best kind is *compost*—a mixture of partly decayed plant material and soil. Also apply 2 to 4 pounds (0.9 to 1.8 kilograms) of mineral fertilizer per 100 square feet (9 square meters) of land. Mineral fertilizer, which dissolves, will nourish the subsoil as well as the topsoil (see **Fertilizer** [Kinds of fertilizers]). Mix the fertilizer and soil with a rotary tiller to a depth of 4 to 5 inches (10 to 13 centimeters). Then, rake and level the soil before planting grass.

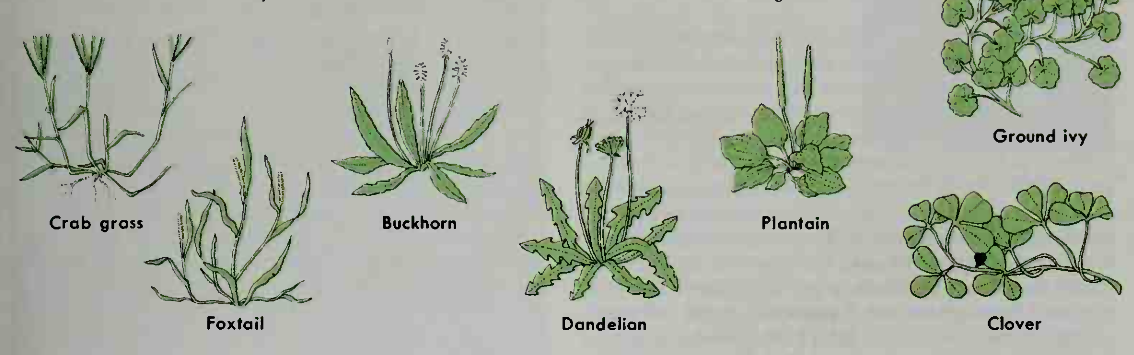
Planting the grass. Be sure to use a variety of grass that is suitable for the climate. The most widely grown lawn grass is Kentucky bluegrass, which thrives in most climates. Bentgrass, a fairly common lawn grass, can grow in acid soil that has poor drainage. However, people seldom use bentgrass for home lawns because of the high cost of maintaining it.

Lawn grasses that grow well in cool, humid areas include bluegrasses, fescues, and bentgrass. White clover may be planted with them to improve the fertility of the soil. Many commercial seed mixtures for cool, humid regions contain some ryegrass seed. Such seed grows quickly and produces a lawn rapidly. But ryegrass lives only a short time before it disappears, leaving room for the longer-lasting grass in the seed mixture. Ryegrass is sometimes called *nurse grass*.

Lawn enemies

Weeds

The plants shown below are among the most common lawn weeds. They may be removed by hand or with tools, or they can be controlled with chemicals. Manufacturers make a variety of substances that kill weeds or prevent their growth. Such products may be spread or sprayed onto the lawn. Some of them affect only weeds, but others also include a fertilizer that nourishes the grass.



Insects

Common lawn pests include grubs, sod webworms, and chinch bugs. Grubs feed on the roots of grass. Sod webworms eat plant leaves and stems. Chinch bugs damage leaves by sucking the juice from them. If not controlled, some insects can ruin a large section of lawn in a short time. Insects, like weeds, can be controlled with a variety of chemical products.



WORLD BOOK illustrations by Margaret Ann Moran

Diseases

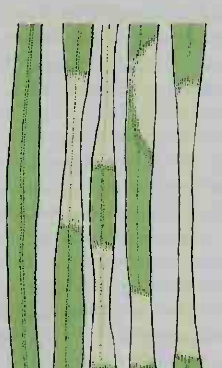
Most lawn diseases are caused by some kind of fungus. A fungus attack results in discolored or damaged leaves and may kill an entire lawn. Various diseases affect different kinds of grass and thrive in different climates. Most diseases may be controlled with chemicals, but some, such as stripe smut fungus, can be controlled only by planting disease-resistant grass.



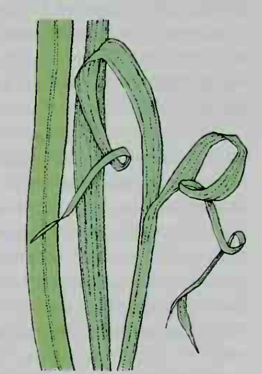
Leaf spot fungus



Rust fungus



Dollar spot fungus



Stripe smut fungus

Common lawn grasses in warm, humid regions include Bermuda grass, St. Augustine grass, and zoysia grass. Carpet grass and centipede grass are also grown in such locations. Grama grass and buffalo grass do well as lawn grasses in dry regions. See **Grass**.

Grass can be planted in three ways: (1) seeding, (2) sodding, or (3) sprigging.

Seeding is the commonest and cheapest method of planting grass. The seeds can be distributed by hand on most lawn sites. For large areas, you should use a push-type seeder, which can also be used to spread grain-type fertilizers and pesticides.

The best time to sow seed is in early fall or early spring. First, divide the seed into two equal amounts. Sow half the seed by walking back and forth over the soil. Sow the other half by walking at right angles to the first direction. Cover the seed by raking the soil lightly, but be sure not to bunch the seed. Roll the soil lightly to provide a compact surface. You may cover the soil with a light layer of clean straw. This cover, called *mulch,* helps conserve moisture, prevent erosion, and protect the seedlings from drying out. Water the soil lightly and frequently until the lawn has developed fairly well.

Sodding is the most expensive way to plant grass. Sections of soil already covered with grass are dug up, carried to the lawn site, and laid over the soil. This method is used mostly on small areas where grass is needed quickly, or on slopes that would otherwise erode.

Select sod carefully so that it contains as little straw, leaves, and other plant matter as possible. An accumulation of plant matter on the soil's surface blocks water and nutrients that the grass needs to grow. Sod may be obtained from a garden supply center or a professional landscaper. Most sodding is done by professionals.

Sprigging involves the use of *sprigs* (small chunks or cuttings of grass). Sprigs are planted at various intervals, depending on the kind of grass. As sprigs grow, their low-lying stems creep along the ground, root in the soil, and fill in the lawn site. Sprigging is used chiefly in regions where grass cannot be grown from seed.

Caring for a lawn

The care of a lawn involves such tasks as (1) mowing; (2) watering; (3) fertilizing; and (4) controlling diseases, pests, and weeds.

Mowing. The height to which grass should be cut depends chiefly on the kind grown. For example, bent grass may be mowed to a height of 1 inch (2.5 centimeters) or less. Other varieties, including bluegrass and St. Augustine grass, should be mowed to a height of $1\frac{1}{2}$ inches (4 centimeters) or more.

A manual or push-type mower is well suited for a lawn smaller than 500 square feet (46 square meters). Power mowers are easy to use on any size lawn. A riding mower or a small tractor with a mower attachment works best on lawns larger than $\frac{1}{2}$ acre (0.2 hectare).

A power mower may have a battery, an electric, or a gasoline motor and a reel-type or rotary blade. A reel mower resembles a manual mower but is powered by a motor or pulled by a tractor. It is best used on lawns that require close cutting. A rotary mower has a propeller-like blade that spins rapidly. It costs less than a reel mower, and it is easier to operate and maintain.

Watering of lawns is unnecessary in most climates because of the normal rainfall. Even during dry periods, a lawn should not be watered more than once a week.

Fertilizing. Most lawns must be fertilized twice a year. Early each spring and fall, spread from 15 to 25 pounds (7 to 11 kilograms) of mineral fertilizer on every 1,000 square feet (93 square meters) of lawn. The amount of nitrogen in the fertilizer applied during one year should not exceed 4 pounds per 1,000 square feet (1.8 kilograms per 93 square meters). Be sure to distribute the fertilizer evenly, which can best be done with a push-type spreader. Fertilizer should be applied in much the same way as grass seed is sown. When the spreader is stopped or turned around, it should be turned off so that too much fertilizer does not fall on one area.

Using too much chemical fertilizer can harm the lawn and the environment. For example, overfertilizing with chemicals may produce grass with shallow roots or compact the soil too tightly. Such conditions prevent the grass from receiving enough water and nutrients. Overfertilization with chemicals also may pollute *ground water,* which supplies wells and springs. People can avoid these dangers by using organic fertilizers.

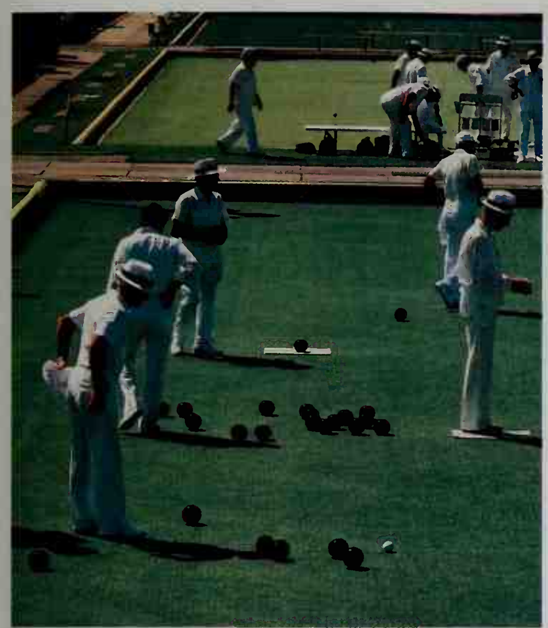
Controlling diseases, pests, and weeds. Common lawn diseases include brown patch, dollar spot, fusarium, and leaf spot. Like most lawn diseases, they are caused by a type of fungus. Such diseases may be controlled by fungicides. Pests that may infest lawns include ants, army worms, chinch bugs, cutworms, grubs, mole crickets, and webworms. They can be kept under control with insecticides. The most common lawn weeds include chickweed, clover, crab grass, dandelions, plantains, and thistles. They probably cannot be prevented from growing. But they can be kept from spreading by applying chemical weedkillers or by digging out their roots with a V-pointed knife. Elvin McDonald

Lawn bowling is a game in which the players roll wooden or plastic balls at a smaller target ball. Lawn bowling traditionally is played outdoors on a smooth, level, grass plot called a *green.* But the game may also be played indoors on an artificial surface.

A standard bowling green measures about 120 feet (36.6 meters) square. It consists of six to eight *rinks* (alleys), each 14 to 19 feet (4.3 to 5.8 meters) wide by 120 feet long. Up to eight matches can be played at once.

The *bowls* (balls) vary in size from $4\frac{11}{16}$ to $5\frac{1}{8}$ inches (11.9 to 13 centimeters) in diameter and weigh no more than $3\frac{1}{2}$ pounds (1.6 kilograms). They are not round. One side of a bowl is larger than the other, and this shape causes the bowl to roll in a curving line. The players control the amount of curve by the manner and speed of their delivery. They bowl from a rubber or plastic mat at each end of the rink. The target ball, called the *jack,* is round and has a diameter of about $2\frac{1}{2}$ inches (6.35 centimeters). The jack weighs about 10 ounces (283 grams).

The game may be played by *singles, pairs, triples,* or *fours* (teams of one to four players). The players try to roll their bowls as close as possible to the jack. Players also try to knock an opponent's bowl away from the jack or to knock the jack away from an opponent's bowl. In addition, players may try to guard a bowl that was thrown by a teammate. Each side faces the challenge of the jack's position, as well as the course of the bowls



Frazier Photo Library

Lawn bowling is a game in which players roll balls at a white target ball. The game is played on grass or artificial turf.

and the need to counter the other team's strategy.

The first bowler, called the *lead,* rolls the jack to the far end of the rink. The lead then delivers the first bowl as directed by the team's *skip* (captain). Then the lead of the other team bowls. Opposing players alternate turns until each player has delivered the permitted number of bowls. The skip bowls last. Each player uses four bowls in singles and pairs, three in triples, and two in fours. A team scores one point for each bowl lying closer to the jack than the nearest bowl of the opponent.

After both sides have delivered all bowls from one end of the rink, they have completed an *end* (inning). They play the next end from the other end of the rink. Games of pairs, triples, and fours consist of a certain number of ends, usually 12 or 14. A singles game is usually played until one player has scored 18 or 21 points. Tournament games may be longer.

Lawn bowling dates back to ancient Egypt, Greece, and Rome. It has flourished in England since the 1100's. Today, about 20 nations, including the United States and Canada, have lawn bowling associations. These organizations sponsor annual tournaments.

Critically reviewed by the American Lawn Bowls Association

Lawrence, D. H. (1885-1930), was a British writer known chiefly for his novels. His fiction shows deep concern for the complicated, often tortured relationships between men and women. Many of his works deal with people torn by the need for both love and independence.

David Herbert Lawrence was born in Eastwood, a coal-mining town in Nottinghamshire. His first major novel, *Sons and Lovers* (1913), describes his early life there. This novel, like most of Lawrence's other works, criticizes social attitudes that he believed were filled with hypocrisy and self-deception. It urges men and women to follow their instincts and is highly critical of industrial society, which Lawrence thought separates people from their feelings.



Grove Press

D. H. Lawrence

Lawrence used experimental techniques and unconventional themes that made him one of the most controversial authors of his time. For example, his frank discussion of sexual passion shocked many readers, and some of his novels were considered obscene. Lawrence's most famous novel, *Lady Chatterley's Lover* (1928), was banned from publication in the United States until 1944, when a shortened version appeared. The complete novel was not published in the United States until 1959.

Lawrence's other novels include *The Rainbow* (1915), *Women in Love* (1920), and *The Plumed Serpent* (1926). A collection of his essays called *Studies in Classic American Literature* (1923) ranks as a classic of literary criticism. Lawrence wrote many short stories, including "The Captain's Doll," "The Fox," "The Man Who Died," "The Rocking Horse Winner," and "The Virgin and the Gypsy."

One of the handful of great British novelists who was also a major poet, Lawrence continually strove for an unorthodox poetic quality in his prose. His nervous, heated, rhapsodic style, which was always driven and sometimes overly repetitive, was one of his most original contributions to the art of fiction.

Lawrence suffered from tuberculosis and traveled widely in an effort to improve his health. He made several trips to Australia, Italy, and Mexico, and these journeys supplied the background for many of his works.

Garrett Stewart

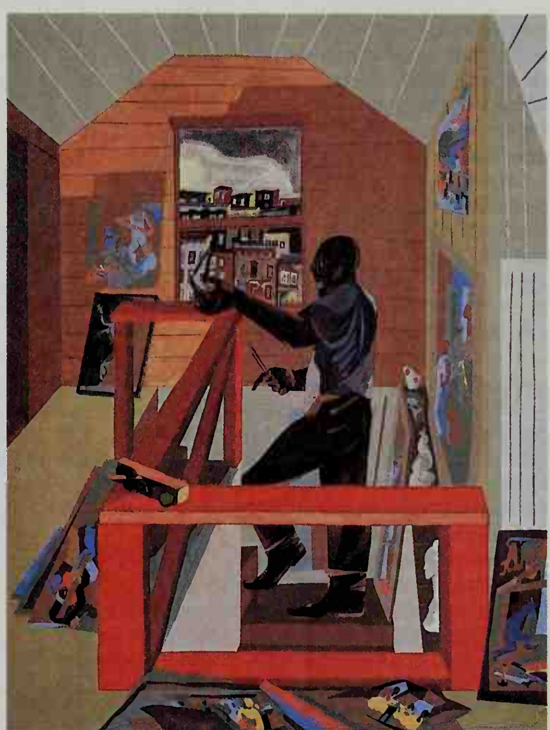
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Lawrence, Ernest Orlando (1901-1958), an American physicist, won the Nobel Prize in physics in 1939 for the invention and development of the *cyclotron* and for results obtained with it. A cyclotron is a machine that accelerates atomic particles between the poles of an electromagnet.

Lawrence started construction of a huge cyclotron at Berkeley, California, before World War II (1939-1945). He converted it during the war to develop a method for separating the isotope 235 of uranium for one of two types of nuclear-fission bomb. After the war, the machine was completed as an accelerator that could speed charged atomic particles to energies equivalent to that of an electron acted on by 400 million volts. In 1948, this machine was the first to detect a subnuclear particle called the *meson* (see **Meson**). In 1954, Lawrence helped complete a more powerful accelerator. He was born in Canton, South Dakota. Bruce R. Wheaton

See also **Cyclotron; Lawrence Berkeley National Laboratory; Lawrence Livermore National Laboratory.**



The Studio (1977), a gouache water color on paper; collection of Gwendolyn and Jacob Lawrence (Seattle Art Museum)

Jacob Lawrence's *The Studio,* like most of his work, uses bright colors and flat shapes that form bold geometric patterns.

Lawrence, Jacob (1917-2000), was an important African American painter. His work portrays the daily life of African Americans and their history. His paintings show busy street scenes, pool halls, bars, and men and women working and relaxing. Lawrence's style is not realistic, but it tells stories in a clear and lively way. He used flat, strongly outlined shapes and bright colors to make bold geometric patterns. He was influenced by the Mexican artists José Clemente Orozco and Diego Rivera, and by such modern American painters as Arthur Dove.

Lawrence painted several series about the lives of famous blacks. The *Toussaint L'Ouverture* series, begun in 1937, deals with the rebellion of African slaves in Haiti. The *Frederick Douglass* series (1938-1939) and others tell stories of oppressed people and their efforts to win liberty and justice for their race. Lawrence was born in Atlantic City, New Jersey. Sarah Burns

See also Literature for children (picture: A history picture book).

Lawrence, James (1781-1813), a United States naval officer, commanded the *Chesapeake* in an attack on the British ship *Shannon* during the War of 1812. The *Shannon* easily captured the *Chesapeake,* and Lawrence was fatally wounded. After he was wounded, he gave the command, "Don't give up the ship," which became a watchword of the U.S. Navy. Lawrence was born in Burlington, New Jersey, and joined the Navy in 1798. In 1812, he took command of the *Hornet,* which captured a number of British ships. Michael J. Crawford

Lawrence, T. E. (1888-1935), a British soldier and writer, became world famous as *Lawrence of Arabia.* He was one of the most adventurous personalities of World War I (1914-1918). In *The Seven Pillars of Wisdom* (1926), he described his exploits in Arabia. A shortened version of his book appeared in 1927 as *Revolt in the Desert.*



Detail of an oil portrait on canvas by Augustus John; Imperial War Museum, London (Bridgeman/Art Resource)

T. E. Lawrence

Thomas Edward Lawrence was born in Tremadoc, Wales. He attended Oxford University, where he studied archaeology and the Near East. When World War I started, Lawrence was working as an archaeologist for the British government. He was sent to Egypt to head the military intelligence department. Later, as a colonel, he helped organize the Arab revolt against the Ottoman Empire and became passionately devoted to the Arab cause. He led daring guerrilla raids and contributed to the defeat of the Ottomans and the entry of the Arabs into Damascus, the capital of Syria. Lawrence refused all honors and decorations. But the Arabs hailed him as a hero, and he was called "the uncrowned king of Arabia." At the Versailles Conference in 1919, he unsuccessfully pleaded the cause of Arabian independence.

In 1921, Lawrence became adviser on Arab affairs to the British Colonial Office. But he had become uncomfortable with his fame, and he resigned from the post in 1922. Later that year, he joined the Royal Air Force under the name J. H. Ross. His identity was discovered, and he transferred to the tank corps under the name T. E. Shaw. In 1925, he returned to the R.A.F. He legally adopted the name T. E. Shaw. Lawrence died in a motorcycle accident in England. Ian F. W. Beckett

Additional resources

Asher, Michael. *Lawrence: The Uncrowned King of Arabia.* Overlook, 1999.

Wilson, Jeremy. *Lawrence of Arabia.* 1989. Reprint. Atheneum, 1990.

Lawrence Berkeley National Laboratory, in Berkeley, California, is a leading center of research in basic energy and life sciences. Over 1,000 scientists carry out research there, including the study of *elementary particles*—bits of matter, such as electrons and quarks, that have no known smaller parts. Lawrence Berkeley researchers have discovered several new chemical elements. They investigate new energy sources, attempt to find ways of reducing environmental hazards, seek medical uses for radioactive materials, and conduct research in genetics. Research also involves such areas as earth, computer, and materials science. The laboratory's Advanced Light Source provides intense beams of X rays and ultraviolet rays used by university and industry scientists to study materials and biological cells.

The laboratory was established in 1931 to advance physics and biomedical research using the *cyclotron,* a particle accelerator invented by American physicist Ernest O. Lawrence. In 1952, a laboratory in Livermore, California, was established as a branch of the Berkeley lab to form the Lawrence Radiation Laboratories. The

labs were separated and given new names—Lawrence Berkeley Laboratory and Lawrence Livermore Laboratory—in 1971. Lawrence Berkeley National Laboratory took its current name in 1995. It is operated by the University of California under contract with the United States Department of Energy. Toni Grayson Joseph

See also **National laboratory; Particle accelerator.**

Lawrence Livermore National Laboratory, in Livermore, California, is a research facility involved primarily in developing national security systems for the United States. The laboratory has produced nuclear warheads for land and air strategic missiles.

Scientists at the laboratory also conduct research in other areas, such as biology and environmental science. They have developed a laser isotope separation process for enriching uranium and other nuclear fuels. In addition, they are working to produce new forms of energy technology, particularly ones involving the control of fusion for the generation of electricity (see **Fusion**).

Lawrence Livermore National Laboratory is operated by the University of California under contract with the United States government. It was named after the American physicist Ernest O. Lawrence. The laboratory opened in 1952. Toni Grayson Joseph

See also **Lawrence Berkeley National Laboratory; National laboratory.**

Lawrence of Arabia. See Lawrence, T. E.

Lawrencium is an artificially produced radioactive element. It has an *atomic number* (number of protons) of 103. Its chemical symbol is Lr. The most stable form of lawrencium has an *atomic mass number* (total number of protons and neutrons) of 262. This *isotope* has a *half-life* of 3.6 hours—that is, due to radioactive decay, only half the atoms in a sample of isotope 262 would still be atoms of that isotope after 3.6 hours.

In 1961, scientists at Lawrence Radiation Laboratory (now Lawrence Berkeley National Laboratory) in Berkeley, California, claimed that they had produced an element with an atomic number of 103. They had bombarded californium, whose atomic number is 98, with boron, which has an atomic number of 5. In 1965, scientists at the Joint Institute for Nuclear Research in Dubna, Russia, near Moscow, made a rival claim. From 1968 to 1971, both the Berkeley and Dubna groups offered additional evidence for the existence of element 103.

The Berkeley group proposed the name *lawrencium* to honor American physicist Ernest O. Lawrence. This name was accepted by the International Union of Pure and Applied Chemistry (IUPAC). The IUPAC is the recognized authority in crediting the discovery of elements and assigning them names. In 1986, the IUPAC and the International Union of Pure and Applied Physics formed a working group to review the histories of the elements with atomic numbers from 101 to 109. In 1993, the IUPAC accepted the group's decision that the discovery of lawrencium was a cumulative effect of work done at Berkeley and Dubna from 1961 to 1971. Richard L. Hahn

Lawson, Ernest (1873-1939), was an American painter. His style was strongly influenced by his contact with the American impressionist painters John H. Twachtman and J. Alden Weir, and by his studies in Paris and Spain. Lawson painted landscapes and city scenes using rugged, simple forms, brilliant colors, and vigorous brushstrokes. Lawson's sense of independent expression typified artist Robert Henri's own conception of art. Lawson joined a group of realist painters headed by Henri and called *The Eight,* later the *Ashcan School* (see **Ashcan School**). Lawson also helped organize the famous Armory Show in 1913. He was born in San Francisco. Charles C. Eldredge

Lawson, Robert (1892-1957), was an American author and illustrator of children's books. He won the Caldecott Medal for *They Were Strong and Good* (1940) and the Newbery Medal for *Rabbit Hill* (1944). Lawson was the first person to earn both awards. His most popular books are imaginative fantasy tales with animals as the main characters. He also wrote and illustrated humorous stories about historical events, such as *Ben and Me* (1939) and *Captain Kidd's Cat* (1956). Lawson was born in New York City. He first won acclaim for his drawings for Munro Leaf's *The Story of Ferdinand* (1936). Jill P. May

Lawyer is a man or a woman licensed to represent people in a court of law or to counsel them on matters of law. He or she is also called an *attorney,* a *counselor,* or a *solicitor.* A person who seeks a lawyer's services is called a *client.* In the United Kingdom, a lawyer who has the right to argue cases in higher courts is called a *barrister.* The lawyer's duty is to make sure that all points of law and facts that favor the client's case are brought to the court's attention, and that justice is done.

A lawyer's duties usually cover all legal matters, including contracts, wills, and business matters. A lawyer tries to avoid lawsuits by giving legal advice that will keep the client out of trouble. Legally, anyone may act on his or her own behalf in any court. But authorities say it is not wise for an untrained person to do so, except in small claims courts or other courts where procedure is informal and arguments only establish facts.

Learning to become a lawyer requires several years of study. In the United States, all but a few law schools admit only students who have college degrees. Law school usually takes three years to complete. Graduates receive a Doctor of Jurisprudence (J.D.) degree. Almost all states require lawyers to pass a state bar examination before they practice. Sherman L. Cohn

See also **Independent counsel; Law** (A career as a lawyer); **Public defender; Trial** (Presenting evidence).



Collection Whitney Museum of American Art, New York City

Ernest Lawson's *High Bridge* was painted in 1934. It shows the influence of impressionism on this American realist artist.

Laxative is a medicine that speeds the emptying of the *bowels* (intestines). *Mineral oil* is a laxative that helps empty the bowels by lubricating the bowel contents. *Phenolphthalein,* the active ingredient in chewable and chocolate laxatives, has a direct effect on the intestine, but how it works is not clear. Some laxatives, including *Epsom salt,* provide bulk in the form of retained water. The water increases the bowel contents and forces the bowels to empty. Other laxatives, including *castor oil,* act by irritating the walls of the bowels.

Laxatives should not be taken continually over a long period of time because the bowels may become lazy and fail to function on their own. Laxatives may also cause harmful side effects in other parts of the body. They should never be taken by people who have abdominal pain. *Constipation* (difficulty in emptying the bowels) can often be relieved by drinking ample quantities of water and by eating foods containing fiber. These foods include cereals, whole fruits, and leafy vegetables.

André Dubois

Related articles in *World Book* include:

Cascara sagrada
Castor oil
Constipation
Magnesia
Mineral oil
Phenolphthalein

Layton, Irving (1912-), is a Canadian poet. He writes forceful poems that praise creativity and energy. In much of his poetry, Layton opposes the crippling puritanism he sees in society. In his rage, his language is often obscene. But Layton also writes delicate love lyrics.

Layton has written over 35 volumes of poetry, beginning with *Here and Now* (1945). *The Collected Poems of Irving Layton* (1971) is a survey of Layton's work. *A Red Carpet for the Sun* won the 1959 Governor General's Award for poetry. His later poetry was published in such collections as *The Gucci Bag* (1983). Layton's best essays are collected in *Taking Sides* (1977).

Layton was born in Tîrgu Neamţ, Romania, and came to Montreal as a child. He has influenced Canadian verse as a critic, editor, and teacher. Laurie R. Ricou

Lazarus, *LAZ uhr uhs,* in the account of John 11, was the brother of Mary and Martha of Bethany. He was raised from the dead after four days by Jesus Christ. The English poets Lord Tennyson and Robert Browning used this story about Lazarus in poems. American dramatist Eugene O'Neill wrote *Lazarus Laughed* (1927), a play about Lazarus after he was brought back to life. The name also belongs to a beggar in the New Testament parable of the rich man and Lazarus (Luke 16: 19-31). See also Jesus Christ (The miracles). J. H. Charlesworth

Lazarus, *LAZ uhr uhs,* **Emma** (1849-1887), was an American poet. She is best known for her sonnet, "The New Colossus" (1883), which was inscribed on a plaque inside the Statue of Liberty. The text of the sonnet appears in the article Statue of Liberty.

Lazarus was born in New York City. She wrote sentimental poetry about love and death and also translated works by the French author Victor Hugo and the German authors Heinrich Heine and Johann von Goethe. In 1881, violent anti-Jewish attacks took place in Russia, resulting in a wave of Jewish immigration to the United States. The attacks inspired Lazarus, a Jew, to write poetry that emotionally protested against the persecution of the Jews in Russia. The poems were collected in *Songs of a Semite* (1882). Samuel Chase Coale

Lazear, Jesse William (1866-1900), an American physician, became known for his work in controlling yellow fever. In 1900, an outbreak of yellow fever occurred in Havana, Cuba. Lazear was appointed a member of the Yellow Fever Commission, which was organized to study the disease. The commission proved that the bite of a mosquito transmitted yellow fever. During the course of the commission's experiments in Cuba, Lazear was bitten accidentally by an infected mosquito and died of yellow fever.

Lazear was born in Baltimore. He earned a medical degree from Columbia College (now part of Columbia University) in 1892. Matthew Ramsey

See also Reed, Walter.

Leaching. See Irrigation (Providing artificial drainage); Metallurgy (Leaching).

Leacock, Stephen Butler (1869-1944), is the most popular humorist in Canadian literature. He also wrote serious works and was a distinguished professor of economics and political science. Most of his humorous works poke fun good-naturedly at everyday people and events by treating them with mock seriousness.

The majority of Leacock's humorous stories and essays first appeared in magazines and newspapers. The first collection of his works, *Literary Lapses,* was published in 1910. Leacock's best-known book is *Sunshine Sketches of a Little Town* (1912), a charming portrait of life in a small town based on Orillia, Ontario. About 35 of Leacock's more than 60 books were humorous. The others included biographies and works on political science, economics, history, and literary criticism.

Leacock was born in Swanmore, England, near Southampton. His family moved to a farm near Lake Simcoe, Ontario, when he was 7 years old. Leacock taught political science at McGill University from 1903 to 1936. His unfinished autobiography, *The Boy I Left Behind Me,* was published in 1946, after his death. Rosemary Sullivan

Lead, a heavy, bluish-gray element, was one of the first metals used by humans. Compared to other metals, lead has a low melting point, is soft, and can be easily shaped. Because of these properties, people have used lead for thousands of years in coins, vessels, pottery, and projectiles. Today, the main use of lead is in the



WORLD BOOK photo

Lead, *foreground,* is refined mainly from *galena,* a gray metallic ore, *background.* Much lead is also obtained by removing it from scrap products and recycling it.



Johnson Controls, Inc.

Lead-acid storage batteries make up the largest single use of lead. Workers make and install lead terminal posts for the batteries, as shown here.

lead-acid storage battery, which provides power for the electrical systems of automobiles, airplanes, and many other vehicles. See **Battery** (Lead-acid batteries).

In the past, lead was widely used in paints and gasoline. Because of the impact of lead on human health and the environment, people became concerned about the use of lead. The human body can absorb lead, resulting in lead poisoning under certain circumstances. Lead poisoning may occur among workers in plants where large quantities of lead fumes or dust are generated, and where exposures are long-term.

Lead poisoning can also occur in children who eat chips of lead-based paint that have flaked from painted surfaces in older homes. Today, lead use in paints and gasoline has been greatly reduced. This effort has essentially stopped the input of lead into the general environment in most industrialized nations. Lead is still released into the environment in many developing countries.

Lead produced from mined ore is called *primary lead.* The world's annual production of primary lead is about 3.1 million tons (2.8 million metric tons). An additional 3.2 million tons are produced from recycling, mainly from lead-acid storage batteries. The process typically used to recover lead from batteries includes draining the acid, shredding the batteries, separating the solids and sludges, and melting and refining the lead components.

Australia is the leading producer of lead. Other major producers include the United States, Canada, China, and Peru. The United States uses about 1.8 million tons (1.6 million metric tons) of lead each year. Most of it is produced by recycling. About 90 percent of the lead mined in the United States comes from Missouri and Alaska. Missouri produces about 412,000 tons (374,000 metric tons) of lead metal each year. Alaska partially processes the lead ore, then ships the resulting concentrates, mainly to Canada, for final processing. In Canada, New Brunswick and British Columbia are major producers.

Properties. Lead has an atomic number of 82 and an atomic weight of 207.2. The melting point of lead is 327.5 °C, and the metal boils at 1749 °C. Lead is also one of the heaviest elements, with a density of 11.4 grams per cubic centimeter. Pure lead is soft and has little strength, which makes it unsuitable for most applications. To make lead stronger, lead producers often *alloy* (mix) it with antimony and tin to form *lead alloys.* Lead occurs naturally as lead sulfide (also known as *galena),* a mineral with a brilliant silver luster.

Lead is soft and can be easily pressed or hammered into thin sheets. Its low melting point makes it easy to recover from ores and scrap. These properties, along with corrosion resistance, made lead useful in roofing and pipes for many centuries. The Latin word for lead is *plumbum,* from which the term *plumbing* is derived. Today, however, most pipes used in plumbing are made from materials other than lead. Lead resists corrosion by water and some acids, particularly sulfuric acid, which makes it useful in chemical industries.

Uses. Over 75 percent of the lead produced in the United States is used in lead-acid batteries. Such batteries are reliable, cheap sources of energy. Other types of batteries can also be used in automobiles. Because they are more expensive than lead-acid batteries, however, they are not widely used.

Lead alloys have a variety of uses. Many manufacturers use a lead-tin alloy called *solder* to join metal surfaces. Lead alloys are used in radiation shields, which provide protection in hospitals, nuclear reactors, and other facilities that use X rays and radioactive materials. Machinery manufacturers may use lead in alloys called *babbitt metals,* and use the alloys to make bearings. Bearings reduce friction between moving parts. Babbitt metals often consist of lead mixed with antimony, tin, and other metals. There are also several commercially important lead compounds, which are used in ceramics, glasses, rubber products, insecticides, and explosives. See **Babbitt metals; Solder.**

Production. Typically, mining companies will develop a lead deposit in the earth's crust if the lead content is at least 3 percent. Most deposits of galena and other lead ores contain some copper, gold, silver, and zinc. Nearly all lead ores are found underground and then extracted using explosives and mechanical equipment.

After mining, the lead ore is processed by crushing and then grinding in water to a particle size less than 100 *micrometers* (0.1 millimeter). Grinding frees the particles of galena from the other mineral particles.

The particles are then separated in a process called *froth flotation.* In this process, surfaces of galena particles are chemically activated so that they can attach to air bubbles. The bubbles are passed through the water-and-mineral mixture that was produced by grinding. The bubbles carrying the attached galena particles rise to the surface of the flotation cell. There, they form a froth or concentrate that contains 75 to 80 percent lead.

Next, the froth goes to a large cylindrical thickening tank. The solid particles settle to the bottom of the tank, forming a thick sludge. The sludge is then treated by a vacuum filter process in which most of the water is sucked through a cloth, leaving a relatively dry concentrate. This goes to a smelter for further processing. Zinc and copper metals can also be recovered in this fashion.

The unwanted minerals are discharged as a waste or *tailings.* The tailings are usually discarded into carefully controlled and monitored surface areas called *tailing ponds.* Sometimes, tailings are used to fill sections of the mine from which the ore was removed.

Leading lead-mining countries

Tons of lead mined in a year

Country	Tons
Australia	681,200 tons (618,000 metric tons)
China	612,900 tons (556,000 metric tons)
United States	543,400 tons (493,000 metric tons)
Peru	286,300 tons (260,000 metric tons)
Canada	208,700 tons (189,000 metric tons)
Mexico	192,900 tons (175,000 metric tons)
Sweden	154,300 tons (140,000 metric tons)
South Africa	92,600 tons (84,000 metric tons)
North Korea	88,200 tons (80,000 metric tons)
Poland	66,100 tons (60,000 metric tons)

Figures are for 1998.
Source: U.S. Geological Survey.

The lead sulfide concentrate is first *sintered* (fused by heating without melting) to burn off the sulfur. The sulfur combines with oxygen to escape as sulfur dioxide gas. This gas is typically converted into sulfuric acid. The lead in the concentrate also combines with oxygen to produce lead oxide in a porous form known as *sinter*.

The sinter is then smelted with carbon in a blast furnace. During smelting, air is blown into the furnace. The heat created enables chemical reactions to occur, reducing the lead oxide to metallic lead. The lead metal is then tapped from the bottom of the blast furnace. Waste products, called *slag,* are tapped separately.

The crude lead metal produced in the blast furnace is called *bullion.* This metal contains impurities such as copper, silver, and gold. In the refining process, these impurities are removed and saved for other uses. Several different refining processes are used, but typically lead is refined by the control of temperature and the addition of zinc. These processes cause the impurities to float, as solids or liquids, on top of the dense, molten lead metal. The impurities can then be skimmed from the surface of the lead. The refined product that results is about 99.9 percent lead. Refined lead is usually cast in large masses, called *ingots,* weighing 1 ton (0.9 metric ton); and in smaller masses, called *pigs,* which weigh 100 pounds (45 kilograms).

The recycling of lead has become important in many countries. Today, more than 65 percent of the lead used in the United States is recycled. The United States has limited known reserves of lead ore. Unless additional reserves are found, recycling and importing will assume greater importance. John L. Watson

See also **Galena; Lead poisoning.**

Lead, *leed,* South Dakota (pop. 3,027), is the site of the Homestake mine, one of the largest gold mines in the United States. The mine began operations on April 9, 1876. It closed at the end of 2001.

The town stands in the Black Hills of western South Dakota. For the location of Lead, see **South Dakota** (political map).

Lead was founded in 1876. It has a commission form of government. Max Wetz

Lead poisoning is an illness caused by excess lead in the body. It may result from swallowing objects that contain lead or from inhaling lead dust or fumes. Some forms of lead can be absorbed through the skin.

Lead poisoning afflicts many children who eat chips of or inhale dust from dried paint that has a high lead content. Such paint is found in many older homes. Lead poisoning also strikes adults who work in smelting, battery manufacturing, and other industries that use lead. Such industries may pollute the environment with lead dust and fumes, which may cause poisoning in people who live near the plants. Another source of lead pollution is exhaust from machines that use leaded gasoline.

Lead interferes with the production of red blood cells and may damage the brain, liver, and other organs. Symptoms of lead poisoning include headaches, irritability, and weakness. Many victims experience abdominal pain, vomiting, and constipation, a group of symptoms sometimes called *painter's colic* or *lead colic.* In severe cases, victims may have convulsions, enter a coma, and become paralyzed. Such cases may be fatal.

In the late 1970's, researchers found that even small amounts of lead absorbed by the body over a long period can harm a child. Although such absorption does not cause physical illness, it can damage a child's brain and result in learning difficulties.

Physicians can detect lead poisoning by testing samples of a person's urine or blood and by taking X rays of the bones. If the illness is detected early, permanent damage may be prevented. Doctors recommend that children between 1 and 6 years old who may have been exposed to lead be tested for lead poisoning at least once a year.

Physicians treat lead poisoning with drugs that help the body discharge lead through the urine. Treatment may last several months. Many cases can be prevented by reducing the amount of lead in the environment. The United States government bans lead-based paint for household use, restricts it in certain other products, and regulates its use in industry. The government also sets air quality standards that limit the amount of lead that can be released into the air. Raymond Demers

See also **Chelation therapy.**

Leadville, Colorado (pop. 2,821), is often called *Cloud City* because it is the highest incorporated city in the United States. It lies in the central part of the state (see **Colorado** [political map]). The city was named Leadville because of the large quantities of lead ore once found in the area. Silver, gold, iron, copper, bismuth, manganese, molybdenum, tungsten, and zinc were also mined in the region. The last major mining operations closed in the late 1900's. Leadville is a center for fishing, skiing, and other outdoor recreational activities. It is the home of the National Mining Hall of Fame and Museum.

The discovery of silver-lead mines brought thousands of people to Leadville after 1878, the year the city was incorporated. Leadville has a mayor-council government and is the seat of Lake County. Christine McGinnis

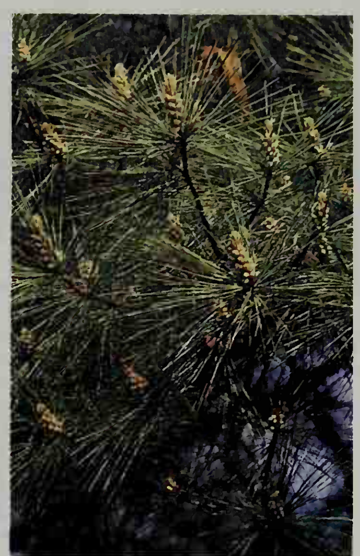
Leadwort. See **Plumbago.**



Edward S. Ross



Tony Castelvecchi, Foto Place



Leonard Lee Rue III, Bruce Coleman Inc.

Leaves, the chief food-making parts of plants, vary greatly in appearance. Most plants have broad, flat leaves, such as those of a maple tree, *left.* But oats, *center,* and other grasses have long, narrow leaves. Pines, *right,* and most other cone-bearing plants have needle leaves.

Leaf

Leaf is the main food-making part of almost all plants. Garden flowers, grasses, shrubs, and trees depend on their leaves to make food for the rest of the plant. So do many other plants, including ferns, vegetables, vines, and weeds.

Each leaf is a little food factory. It captures energy from sunlight and uses it to make sugar out of water from the soil and *carbon dioxide,* a gas in the air. This sugar is changed to many other chemical substances. These substances become the food that provides plants with energy to grow, to produce flowers and seeds, and to carry on all their other activities. Plants store the food made by leaves in their fruits, roots, seeds, stems, and even in the leaves themselves. Without this food, plants could not live. In addition, all the food that people and animals eat comes either from plants or from animals that eat plants.

Leaves vary in appearance among plants. Many are oval, but others are shaped like arrowheads, feathers, hands, hearts, or any number of other objects. However, most leaves can be divided into three groups according to their basic shape. (1) *Broad leaves* are the type of leaf that most plants have. These leaves are fairly wide and flat. Plants that have such leaves include maple and oak trees, pea plants, and rosebushes. (2) *Narrow leaves* are long and slender. Narrow leaves grow on grasses. Grasses include not only lawn grasses but also barley, corn, oats, wheat, and other cereal grasses. Lilies, onions, and certain other plants also have narrow leaves.

Nels R. Lersten, the contributor of this article, is Professor of Botany at Iowa State University. The drawings were prepared for World Book *by James Teason, unless otherwise credited.*

(3) *Needle leaves* grow on firs, pines, spruces, and most other cone-bearing trees and shrubs. Needle leaves resemble short, thick sewing needles. A few other kinds of cone-bearing plants, including certain cedars and junipers, have scalelike leaves.

Most leaves grow from 1 to 12 inches (2.5 to 30 centimeters) in length. Some plants, however, have huge leaves. The largest leaves grow on the African raffia palm. The leaves of this tree measure up to 65 feet (20 meters) long. The giant water lily of South America has round, floating leaves that grow up to 6 feet (1.8 meters) across. In contrast, some plants have extremely small leaves. The true leaves of asparagus plants, for example, are so tiny that they are hard to see without a magnifying glass. In these plants, the stems, rather than the leaves, produce food.

The number of leaves on plants ranges from several to thousands. Most soft-stemmed plants have few leaves. For instance, a barley or wheat plant produces only 8 to 10 leaves each season. But trees and shrubs have an enormous number of leaves. A fully grown elm or pine tree produces thousands of leaves.

Some simple plants that manufacture their own food do not have leaves. For example, liverworts and mosses are simple food-making plants that lack true leaves. In some of these simple plants, however, the green food-making tissues look like tiny leaves.

The importance of leaves

The chief job of leaves is to make food for plants. This food-making activity, called *photosynthesis,* occurs mostly in fully grown leaves. But young leaves also are important. They wrap tightly around the tips of growing stems. They thus keep the delicate tips moist and help protect them from insects, cold, and other dangers.

Leaves are also vital to animals. Animals cannot make their own food. They depend on plants for their basic

supply of food. Many animals eat leaves. For example, antelope, sheep, and other grazing animals eat grass leaves. People also eat leaves, such as those of cabbage, lettuce, and spinach plants. But even when people and animals eat the fruits, roots, seeds, and stems of plants, they are obtaining food made by leaves. In the same way, eggs, meat, milk, and all other animal foods can be traced back to food made by photosynthesis.

Leaves help make the air breathable. They release oxygen during photosynthesis. People and animals must have oxygen to live. Without the activities of leaves, the earth's supply of breathable oxygen would probably soon be used up.

People obtain many products from leaves in addition to food. For instance, we use the leaves of the tea plant to make tea. Peppermint and spearmint leaves contain oils used to flavor candy and chewing gum. Such leaves as bay, sage, and thyme are used in cooking to flavor foods. Some drugs come from leaves. For example, the drug digitalis, which is used to treat certain heart diseases, comes from the leaves of the purple foxglove, a common garden flower. Leaves of abacá and sisalana plants provide fiber used in making rope. Finally, the leaves of the tobacco plant are used to make cigarettes, cigars, and other tobacco products.

The life story of a leaf

A leaf begins its life in a bud. Buds are the growing areas of a stem. They form along the sides of the stem, at the point just above where a fully grown leaf is attached. A bud also grows at the tip of the stem. A leaf bud contains undeveloped leaf and stem tissues. Within the bud is a mound slightly larger than the head of a pin. Each leaf starts out as a tiny bump on the side of this mound. The mature bud contains a tightly packed group of tiny leaves.

In most soft-stemmed plants, the buds are hard to see. A new leaf becomes noticeable only after it begins to unfold. Most soft-stemmed plants continue to form new leaves until the plants flower or until cold weather sets in. In *temperate regions,* which have warm summers and cold winters, the aboveground parts of many soft-stemmed plants die after the first hard frost, but the roots live through the winter. Other soft-stemmed plants die completely after the cold weather arrives.

Woody plants, on the other hand, may live many years. They grow several sets of leaves during their lifetime. Most needleleaf trees and shrubs shed old leaves and grow new ones continuously throughout the year. So do most broadleaf trees in the tropics. But in temperate regions, most broadleaf trees and shrubs are *deciduous.* Deciduous plants of temperate regions shed all their leaves each fall and grow a new set each spring.

Deciduous trees and shrubs start growing the next year's leaves even before the present year's leaves have fallen. The new leaves are enclosed in *winter buds.* The leaves in the winter buds stop growing during the summer and remain *dormant* (inactive) throughout the winter. During the winter months, the buds are protected from drying out by special outer leaves called *bud scales.* In spring, warmth and moisture cause the dormant leaves to become active. The bud scales drop off, and the leaves unfold.

The leaf becomes fully grown. Leaves complete their growth within one week to several weeks, depending on the kinds of plants that produce them. At first, the unfolding leaf must get all its food from older leaves or from food stored by the plant. Soon, however, the young leaf turns a deeper green and begins to make its own food. Gradually, the leaf produces extra food, which is sent to the rest of the plant.

During the growing season, the color of the leaf changes from bright green to a duller green. The leaf also becomes tougher because its cells develop thicker walls. During this time, a special change occurs in the leaves of deciduous trees and shrubs. A corky layer of cells known as the *abscission zone* develops where the stalk of the leaf joins the stem. This zone breaks down in autumn, causing the leaf to separate from the stem.

The leaf changes color. The leaf is green because it contains a green *pigment* (coloring matter) called *chlorophyll.* This pigment plays a major role in photosynthesis. The leaf also has other colors, but they are hidden by the chlorophyll. As autumn approaches, however, the shorter days and cooler nights cause the chlorophyll in deciduous broad leaves to break down.

The hidden colors of the leaf appear as the chlorophyll breaks down. The leaf may then show the yellow color of the pigment *xanthophyll* or the orange-red tones of the *carotene* pigments. In addition, a group of red and purple pigments called *anthocyanins* forms in the dying leaf. The color of the autumn leaf depends on

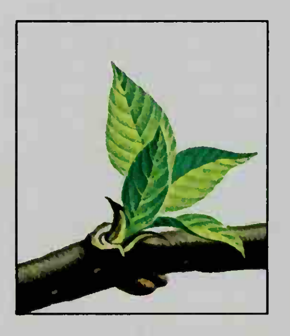
How leaves develop on a lilac bush



Leaves form inside a bud. The *winter bud* above protects tiny leaves in winter.



The bud opens in spring as warmth and moisture cause the bud scales to fall off.



The young leaves unfold. As they turn a darker green, they begin to make food.



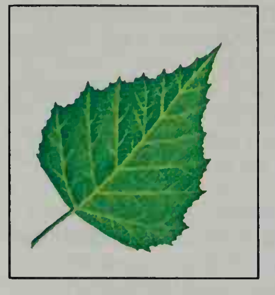
A twig develops with many young leaves several weeks after the bud has opened.

Leaf edges

The blades of broadleaf plants have three chief types of edges: (1) smooth, (2) toothed, and (3) lobed. Smooth-edged leaves are most common on plants native to warm climates. Many temperate broadleaf plants have jagged, toothed blades. Other temperate species have lobed blades, which look as if large bites were taken out of them.



Smooth-edged leaf blade
(Rubber plant)



Toothed leaf blade
(White birch)



Lobed leaf blade
(White oak)

which of the pigments is most plentiful in the leaf.

The leaf dies. After the chlorophyll breaks down, the leaf can no longer make food. The tiny pipelines between the leaf and the stem become plugged. These pipelines carried water to the leaf and food from it. The cells in the abscission zone separate or dissolve, and the dying leaf hangs from the stem by only a few strands. These strands dry and twist in the wind. When the strands break, the dead leaf floats to the ground.

After the leaf falls, a mark remains on the twig where the leafstalk had been attached. This mark is called a *leaf scar.* The broken ends of the water and food pipelines can be seen within the leaf scar.

On the ground, the dead leaf becomes food for bacteria and fungi. They break the leaf down into simple substances, which then sink into the soil. There, these substances will be absorbed by plant roots and provide nourishment for new plant growth.

The parts of a leaf

Most leaves have two main parts: (1) the blade and (2) the petiole, or leafstalk. The leaves of some kinds of plants also have a third part, called the *stipules.*

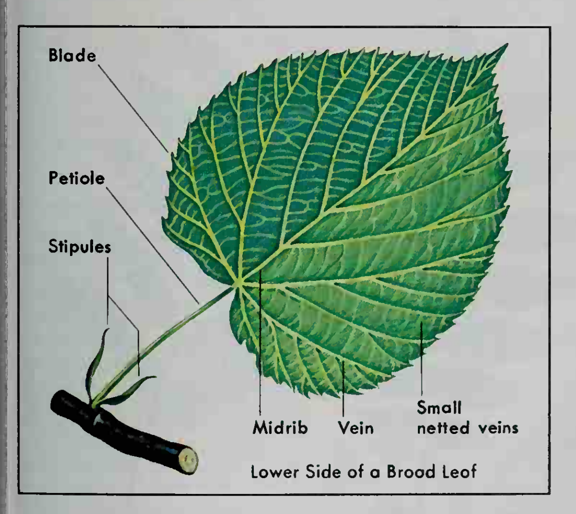
The blade, or *lamina,* is the broad, flat part of the leaf. Photosynthesis occurs in the blade, which has many green food-making cells. Leaf blades differ from one another in several ways. The chief differences are in: (1) the types of edges, (2) the patterns of the veins, and (3) the number of blades per leaf.

The types of edges. Almost all narrow, grasslike leaves and needle leaves have a blade with a smooth edge. But the edge of broadleaf blades varies greatly among the different types of plants.

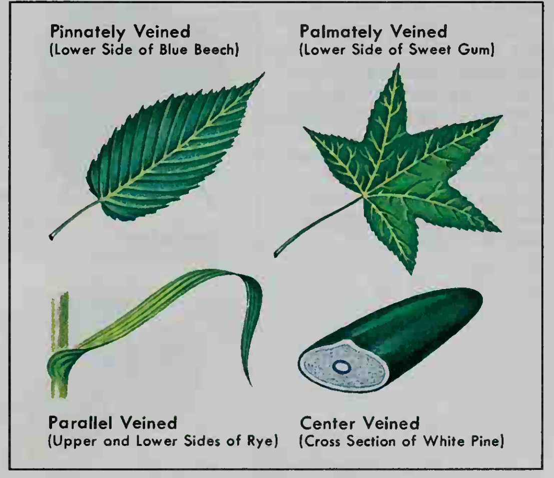
Many broadleaf plants, particularly those that are native to warm climates, have smooth-edged leaf blades. The rubber plant, a common house plant, is a good example of such a plant.

The leaves of many temperate broadleaf plants have small, jagged points called *teeth* along the blade edge. Birch and elm trees have such leaves. In many plants, the teeth contain *hydathodes,* tiny valvelike structures that can release excess water from the leaf. The teeth of young leaves on many plants, including cottonwood and pin cherry trees, bear tiny glands. These glands produce liquids that protect the leaf from plant-eating insects.

Some temperate broadleaf plants—including sassafras trees and certain mulberry and oak trees—have *lobed* leaves. The edge of such a leaf looks as if large bites have been taken out of it. The lobing helps heat escape from the leaf.



The parts of a leaf. Most leaves have two main parts: (1) a flat *blade* and (2) a stemlike *petiole.* The leaves of many plants also have a third main part, two small flaps called the *stipules.*



Vein patterns differ among leaves. Most broad leaves have a *pinnate* (featherlike) or *palmate* (palmlike) vein pattern. Grasses have parallel veins. Needle leaves have one or two center veins.

The patterns of the veins. Veins are pipelines that carry food and water in a leaf. If you hold a leaf blade up to light, you can see the pattern of its veins.

In most broad leaves, the veins form a netlike pattern, with several large veins connected by many smaller ones. The smallest veins supply every part of the blade with water. They also collect the food made by the green cells.

There are two main types of net-vein patterns—*pinnate* (featherlike) and *palmate* (palmlike or handlike). Pinnately net-veined leaves have one large central vein, called the *midrib,* which extends from the base of the blade to its tip. Other large veins branch off on each side of the midrib. The leaves of beech, birch, and elm trees have such a vein pattern. A palmately net-veined leaf has several main veins of about equal size, all of which extend from a common point at the base of the blade. The vein patterns of maple, sweet gum, and sycamore leaves are palmate.

Narrow leaves and needle leaves are not net-veined. Narrow leaves have a parallel-vein pattern. Several large veins run alongside one another from the base of the blade to the tip. Small crossveins connect the large veins like steps on a ladder. Needle leaves are so small that they have only one or two veins. These veins run through the center of the blade.

Leaf veins do more than carry water and food. They also support the blade, much as the metal ribs support the fabric of an open umbrella. The veins are tougher and stronger than the green tissue around them. They help the leaf keep its shape and prevent it from collapsing or tearing.

The number of blades per leaf. A leaf may have one or more blades. A leaf that has only one blade is called a *simple leaf.* Apple and oak trees, grasses, and many other kinds of plants have simple leaves. A leaf that has more than one blade is known as a *compound leaf.* The blades of a compound leaf are called *leaflets.*

The leaflets in a compound leaf may be arranged in a pinnate or palmate pattern. In pinnately compound leaves, the leaflets grow in two rows, one on each side of a central stalk, called the *rachis.* Plants with pinnately compound leaves include ash and walnut trees and garden peas. The leaflets in a palmately compound leaf are attached at the tip of the leafstalk. Clover, horsechestnut trees, and many other plants have palmately compound leaves.

A few plants—including carrots, honey locust trees, and Kentucky coffeetrees—have *double compound leaves.* In double compound leaves, each leaflet is divided into a number of still smaller leaflets. One double compound leaf looks more like a group of twigs and leaves than like a single leaf.

The petiole is the stemlike part of the leaf. It joins the blade to the stem. Within a petiole are tiny tubes, bound together tightly like a bundle of drinking straws. These tubes are a continuation of the midrib veins. Some of the tubes carry water into the leaf. Others carry away food that the leaf has made.

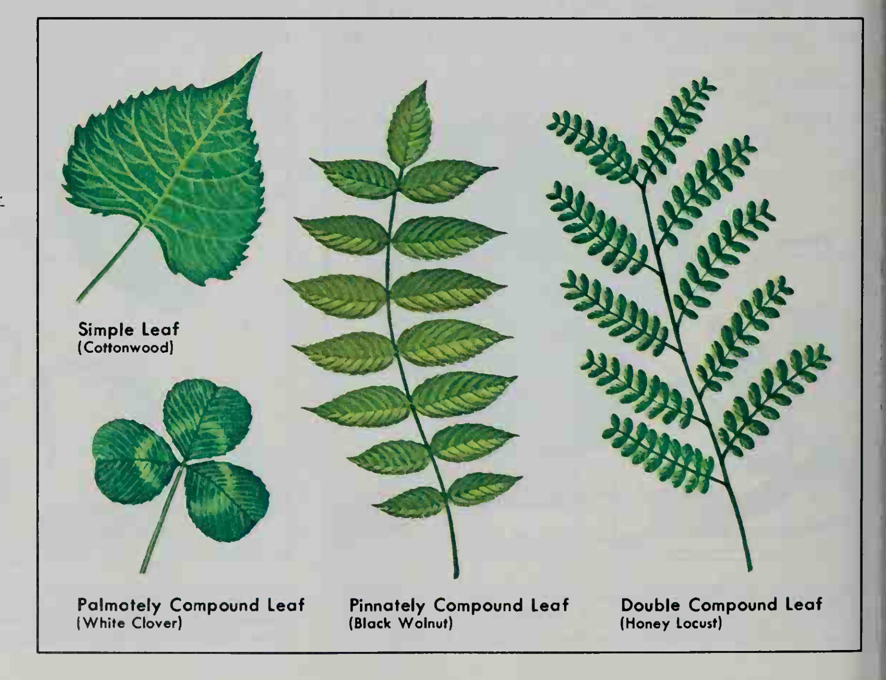
The leaves of many plants have petioles that grow extra long if the blades are shaded. For example, white clover plants growing among unmowed grass may have petioles up to 6 inches (15 centimeters) long. These long petioles lift the clover leaflets into the sunlight. In a lawn where the grass is kept short, the clover petioles may measure less than 1 inch (2.5 centimeters) long.

In many trees and shrubs, the petioles bend in such a way that the blades are turned to receive the most sunlight. As a result of this bending, few of the leaves are shaded by other leaves. The petiole also provides a flexible "handle" that enables the blade to twist in the wind and so avoid damage.

In some plants, the petioles are much larger than the stems to which they are attached. For example, the

Simple and compound leaves

A leaf may have one or more blades. If a leaf has only one blade, it is called a *simple leaf.* A leaf with more than one blade is known as a *compound leaf.* The blades of a compound leaf are called *leaflets.* They may be arranged in a palmate or pinnate pattern. A few plants have *double compound leaves,* in which each leaflet is further divided into still smaller leaflets.



parts we eat of celery and rhubarb plants are petioles. In contrast, the leaves of some soft-stemmed plants, particularly grasses, have no petioles.

The stipules are two small flaps that grow at the base of the petiole of some plants. Many stipules look like tiny green leaf blades. In some plants, the stipules grow quickly, enclosing and protecting the young blade as it develops. Some stipules, such as those of willows and certain cherry trees, produce substances that prevent insects from attacking the developing leaf.

In many plants, the stipules drop off after the blade has developed. But garden peas and a few other kinds of plants have large stipules that persist and become an extra food-producing part of the leaf.

How a leaf makes food

A green leaf is a marvelous food-making factory. Using only the energy of the sun, it takes simple materials and turns them into energy-rich food. This section describes how a leaf obtains the raw materials needed to make food. It then provides a simple explanation of how the leaf produces food through photosynthesis. Finally, this section discusses *transpiration,* a process of water loss that plays a key role in the operation of the leaf food factory.

Obtaining the raw materials. A leaf needs three things to make food. They are (1) carbon dioxide, (2) water, and (3) light. The carbon dioxide and water serve as the raw materials of photosynthesis. The light, which is normally sunlight, provides the energy that powers photosynthesis.

Carbon dioxide enters a leaf from the air. The *epidermis* (outer surface) of the leaf has many tiny pores. These openings, called *stomata,* enable carbon dioxide to enter the leaf. Each pore is surrounded by two curved, bean-shaped *guard cells* that can swell and relax. When they swell, the pore is opened wide, and carbon dioxide enters the leaf. When the guard cells relax, the pore closes. In most plants, the stomata open during the day and close at night.

A leaf has many stomata. For example, a cottonwood leaf may have 1 million stomata, and a sunflower leaf nearly 2 million. However, the pores are so small that they make up less than 1 percent of the leaf's surface. In most plants that grow in full sun, the majority of the stomata are in the shaded lower epidermis of the leaves. In many other plants, the stomata are about equally divided between the upper and lower epidermis.

Water. A leaf obtains water that has been absorbed by the plant's roots. This water travels up the stem and enters the leaf through the petiole. Tiny tubes in the leaf's veins carry the water throughout the blade. These tubes make up the vein's *xylem* (water-transporting tissue).

The inside of the blade is very humid. The epidermis is covered by a waxy coating called the *cuticle,* which helps keep the leaf from drying out. Nevertheless, a leaf does lose much water. Most of it escapes as vapor through the stomata by the process of transpiration.

Light. Leaves cannot make food without light. But most leaves work best when the sunlight is at a certain level of brightness. If the light is too dim, the leaf will not make enough food. But if the light is too bright, it can damage the food-making cells.

The leaves of many plants that grow in bright sunlight have an extremely thick cuticle, which helps filter out strong light and guards against excess water loss. The leaves may also have many hairs growing out of the epidermis. The hairs further reduce the intensity of bright light. Such plants as geraniums and white poplar trees have so many epidermal hairs that they feel fuzzy.

Some plants, including the herbs, ferns, and shrubs of the forest floor, thrive in shade. The leaves of most of these plants have a thin cuticle and few epidermal hairs. These features allow as much of the dim light as possible to enter the leaves.

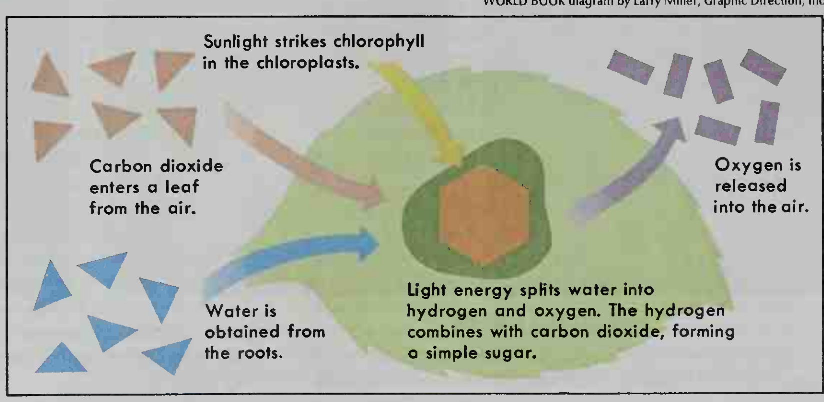
Photosynthesis occurs inside the leaf blade in two kinds of food-making tissues—*palisade tissue* and *spongy tissue.* The tall, slender cells of the palisade tissue are the chief food producers. They form one to three layers beneath the upper epidermis. The broad, irregularly shaped cells of the spongy tissue lie between the palisade tissue and the lower epidermis. Floating within both kinds of cells are numerous small green bodies known as *chloroplasts.* Each chloroplast contains many molecules of the green pigment chlorophyll.

Partly surrounding each cell of the palisade and spongy tissue is an air space filled with carbon dioxide, water vapor, and other gases. The cells absorb carbon dioxide from this air space. When light strikes the chloroplasts, photosynthesis begins. The chlorophyll absorbs energy from the light. This energy splits the water molecules into molecules of hydrogen and oxygen. The hydrogen then combines with carbon dioxide to pro-

WORLD BOOK diagram by Larry Miller, Graphic Direction, Inc.

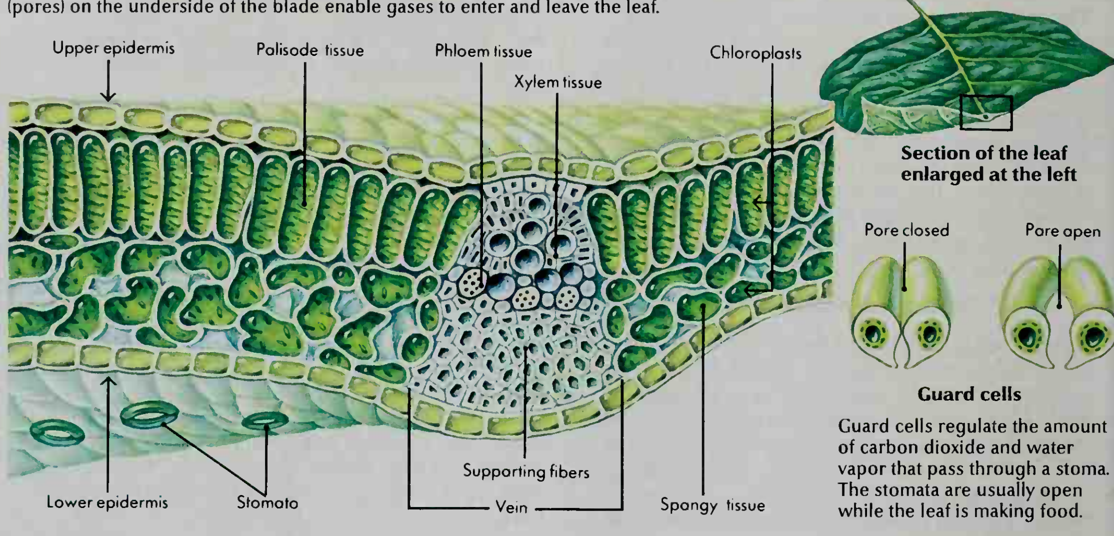
Photosynthesis

Green leaves make food through *photosynthesis.* This process begins when sunlight strikes *chloroplasts,* small bodies that contain a green substance called *chlorophyll.* The chlorophyll absorbs energy from the sunlight. This energy splits water molecules into hydrogen and oxygen. The hydrogen combines with carbon dioxide, forming a simple sugar. Oxygen is released as a by-product.



Inside a typical green leaf

This cross section shows a typical, simple leaf blade. Palisade and spongy cells serve as food producers. In the veins, xylem tissue distributes water, and phloem tissue carries away food. *Stomata* (pores) on the underside of the blade enable gases to enter and leave the leaf.



Guard cells

Guard cells regulate the amount of carbon dioxide and water vapor that pass through a stoma. The stomata are usually open while the leaf is making food.

duce a simple sugar. This process is extremely complicated and involves many steps. The oxygen that is left over from the splitting of the water molecules enters the air through the stomata.

The sugar produced by photosynthesis is carried in special tubelike cells that make up the vein's *phloem* (food-transporting tissue). The sugar moves through the petiole to the stem and all other parts of the plant. In the plant cells, the sugar may be burned and thus release energy for growth or other activities. Or the sugar may be chemically altered and form fats and starches. In addition, the sugar may be combined with various minerals, and so produce proteins, vitamins, and other vital substances. The minerals enter the plant dissolved in the water absorbed by the roots.

Transpiration occurs as the sun warms the water inside the blade. The warming changes much of the water into water vapor. This gas can then escape through the stomata. Transpiration helps cool the inside of the leaf because the escaping vapor has absorbed heat.

Transpiration also helps to keep water flowing up from the roots. Water forms a continuous column as it flows through the roots, up the stem, and into the leaves. The molecules of water in this column stick to one another. As the molecules at the top of the column are lost through transpiration, the entire column of water is pulled upward. This pulling force is strong enough to draw water to the tops of the tallest trees. In addition, transpiration ensures a steady supply of dissolved minerals from the soil.

A plant may lose much water through transpiration. A corn plant, for example, loses about 4 quarts (3.8 liters) of water on a hot day. If the roots cannot replace this water, the leaves wilt and photosynthesis stops.

Specialized leaves

Some leaves have special functions along with or instead of food making. Such specialized leaves include (1) protective leaves, (2) storage leaves, (3) tendrils, (4) bracts, and (5) insect-capturing leaves.

Protective leaves include bud scales, prickles, and spines. As described earlier, bud scales are specialized leaves that protect the young, undeveloped tissues of the bud. Bud scales are short and broad, and they overlap like roof shingles. In many plants, the bud scales have an outer layer of waterproof cells.

Prickles and spines are sharp leaf structures that protect the plant from being eaten. For instance, prickles cover the leaves of the Canada thistle. The prickles protect the plant from grazing animals. Many cactuses have clusters of spines. In many species of cactuses, the pointed spines replace the leaves on the mature plants. In these plants, the green stem has the job of photosynthesis.

Storage leaves. Most plants store food in their roots or stems. However, some plants have special leaves that hold extra food. Onion and tulip bulbs, for example, consist mainly of short, fat storage leaves called *bulb scales.* These leaves cannot make food. Their job is to store food underground during the winter months. See **Bulb**.

Many plants that grow in dry places have thick leaves that store water. The mosslike stonecrop plants that grow on rocky cliffs in the Southwestern United States have such leaves.

Tendrils are slender, whiplike structures that help hold climbing plants in place. They wrap around twigs, wires, and other solid objects.

Among many climbing plants, specialized leaves serve as tendrils. For example, climbing garden peas have compound leaves in which the upper leaflets are threadlike tendrils. In one kind of sweet pea, a garden flower, the entire leaf blade becomes a tendril. The plant's stipules enlarge and take over the food-making job. In the greenbrier vine, the stipules form long, curving tendrils.

Bracts grow just below the blossoms of certain plants. Most bracts are smaller and simpler in shape than a plant's regular leaves. Many members of the daisy family—including daisies, goldenrods, marigolds, and sunflowers—have bracts. These bracts form a cup beneath the plant's cluster of flowers.

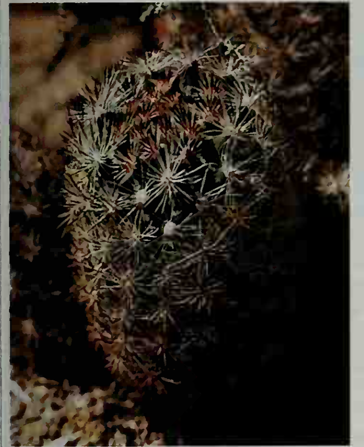
A few kinds of plants, such as the flowering dogwood and poinsettia, have large, showy bracts. These bracts look like part of the flower, but they are not.

Insect-capturing leaves. *Carnivorous* (meat-eating) plants, such as the butterwort, pitcher plant, sundew, and Venus's-flytrap, have leaves that capture insects. These leaves, like other leaves, can make food using sunlight. But they also have features that attract, trap, and then digest insects. Plants with insect-capturing leaves grow in wetlands, where the soil contains little nitrogen. They obtain this necessary nutrient from the captured insects. For a description of these plants and their leaves, see the article **Carnivorous plant**.

How to collect leaves

Collecting leaves or leaf rubbings and prints can be an enjoyable hobby. You can find plants with interesting leaves in fields, forests, and gardens and even along city streets. But before you remove any leaves from a plant, be sure to obtain permission from the owner of the land. In many parks and other public lands, it is illegal to take leaves.

Specialized leaves Some leaves perform special tasks in addition to or instead of food making. Such specialized leaves include protective leaves, storage leaves, tendrils, bracts, and insect-capturing leaves. Some specialized leaves, such as the spines of a cactus plant, do not even look like leaves. Botanists identify these structures as leaves because of their growth patterns.



Ray Hunold

Protective leaves include spines like those on the hedgehog cactus above. They keep animals from eating the plant.



WORLD BOOK photo

Food storage leaves include the bulb scales of a tulip, *above.* These fat leaves store food underground in winter.



Dick Keen

Water storage leaves are common on plants that grow in dry regions. Such plants include the stonecrop, *above.*



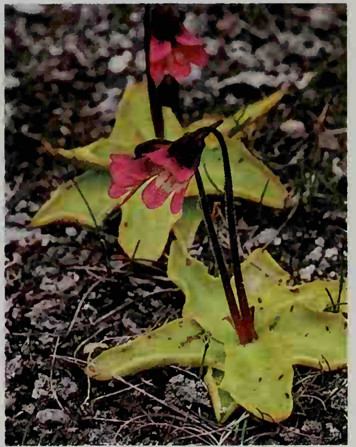
Edward S. Ross

Tendrils hold climbing plants in place. The tendrils of the garden pea plant above are wrapped around wires.



Robert H. Glaze, Artstreet

Bright red bracts surround the flowers of the poinsettia above. These leaves help attract pollinating insects to the flowers.



L West, Bruce Coleman Inc.

Insect-capturing leaves attract, trap, and digest insects. Butterwort leaves, *above,* trap their prey in a sticky film.

When you collect large leaves, remove only a few. Always pick a complete leaf, including the petiole. In most leaves, the petiole will separate easily from the stem. If you are collecting compound leaves, remember to keep all the leaflets attached to the long petiole. When you collect small leaves, you may need to cut off part of a twig. Keep the leaves attached to the twig, and treat the cutting as if it were a single leaf. Always collect the small needle leaves of firs, pines, and spruces this way.

How to preserve leaves. Freshly cut leaves will curl and crack unless you press them. To press leaves, arrange them between several sheets of newspaper. Then place a weight on the newspapers. A piece of plywood with books stacked on it makes a good weight. After a week of pressing, the leaves should remain flat. You can then mount them on stiff paper by placing a strip of tape across the petiole.

How to make leaf rubbings and prints. To make a leaf rubbing, lay the leaf lower-side up on a tabletop. Cover the leaf with a sheet of tracing paper or thin typing paper. Then rub the paper lightly and rapidly with the side of a sharpened soft pencil, a piece of charcoal, or a wax crayon. The outline of the leaf and the larger veins will gradually appear on the paper.

To make a leaf print, you need printer's or etcher's ink and a roller. These materials can be obtained at an art supply store. Use the roller to spread a thin layer of ink on a glass plate or a smooth piece of cardboard. Next lay the leaf lower-side down on the ink. Then place a piece of paper over the leaf and rub the entire leaf with your fingers. After rubbing, remove the paper and carefully pick up the leaf. Place the leaf's inky surface on a sheet of plain paper. Now cover the leaf with another sheet of paper and rub. Be careful not to move the leaf as you rub. After rubbing the leaf, remove the top sheet of paper and the leaf. A print of the leaf will appear on the lower sheet. Nels R. Lersten

Related articles. Many *World Book* articles on individual plants contain information about leaves. For example, see **Ivy; Maple; Palm; Poinsettia.** For illustrations of the leaves of many common North American trees, see **Tree** (Familiar broadleaf and needleleaf trees of North America). See also **Bud; Chlorophyll; Photosynthesis; Plant.**

Outline

I. The importance of leaves

II. The life story of a leaf
- A. A leaf begins its life
- B. The leaf becomes fully grown
- C. The leaf changes color
- D. The leaf dies

III. The parts of a leaf
- A. The blade
- B. The petiole
- C. The stipules

IV. How a leaf makes food
- A. Obtaining the raw materials
- B. Photosynthesis
- C. Transpiration

V. Specialized leaves
- A. Protective leaves
- B. Storage leaves
- C. Tendrils
- D. Bracts
- E. Insect-capturing leaves

VI. How to collect leaves
- A. How to preserve leaves
- B. How to make leaf rubbings and prints

Questions

Why do deciduous broad leaves change color as autumn approaches?
What is *transpiration?*
Why are leaves vital to plants and animals?
How do carnivorous plants obtain nitrogen?
How do simple and compound leaves differ?
What are some products that come from leaves?
How does a leaf obtain carbon dioxide?
What is the *abscission zone?* A *leaf scar?*
How do you make a leaf rubbing?
What is a *petiole?* Do all leaves have one?

Additional resources

Joyce, David. *Foliage: Dramatic and Subtle Leaves for the Garden.* Trafalgar Square, 2001.
Massa, Renato, and others. *The Breathing Earth.* Raintree Steck-Vaughn, 1997. Younger readers.
Ross, Bill. *Straight From the Bear's Mouth: The Story of Photosynthesis.* Simon & Schuster, 1995.
Silverstein, Alvin, and others. *Photosynthesis.* 21st Century Bks., 1998. Younger readers.

Leaf insect is an insect that looks much like a green leaf or a twig. It is sometimes called a *walking leaf* because of this similarity. It is found in Africa, southeastern Asia, and northern Australia, and on the many islands of the South Pacific. Several related species called *walkingsticks* live in America.

The best-known leaf insect is an East Indian species. It is bright green in color and grows about 3 inches (8 centimeters) long. This species looks much like a leaf because of its broad ribbed wings, which fold over its back in the shape of a leaf. It also has leaflike growths on the joints of the legs. The insect's eggs look like the seeds of plants.



Edward S. Ross

Leaf insect

Leaf insects live among the leaves of trees and shrubs, where they are difficult to find because of their shape and color. Leaf insects feed on leaves at night, and they usually stay quiet during the day.

Betty Lane Faber

Scientific classification. The East Indian leaf insect is in the walkingstick family, Phasmidae. Scientists commonly classify leaf insects in the order Phasmatodea.

See also **Walkingstick.**

Leafhopper is one of a large group of small, slender insects that feed on plants. These insects are found throughout the world.

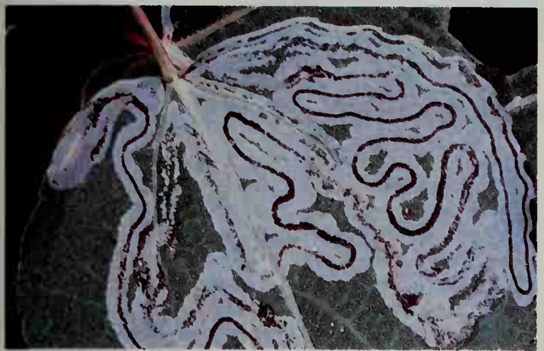
All species have piercing-sucking mouth parts. They rob plants of their juices, causing them to wilt. They run sideways, and the winged species fly easily. Many carry plant diseases. The leafhopper may be brightly colored, or dull brown or green. It is usually only $\frac{1}{20}$ to $\frac{1}{4}$ inch (1.3 to 6.4 millimeters) long, but may be as long as $\frac{1}{2}$ inch (12.7 millimeters). Candace Martinson

Scientific classification. Leafhoppers belong to the order Hemiptera and the leafhopper family, Cicadellidae. The apple leafhopper is *Empoasca mali.*

Leafminer is a tiny beetle, moth, fly, or wasp which, in the larval stage, tunnels between the upper and lower

surfaces of leaves. The leaves provide food and protection for the larvae. Leafminers can often be identified by the shape of the whitish tunnels or blotches they make in leaves and by the plant species they infest. Some leafminers migrate from leaf to leaf. Others tunnel in the stems, roots, or fruits of plants, or feed on the outer surface of leaves. A few species occur in great enough numbers to be very destructive. See **Larva.**

The lives of leafminers begin when female insects lay eggs on leaves. The larvae that hatch from these eggs begin to eat tunnels, or mines, in the leaves. The larvae take from one to three weeks to nearly a year to mature. They then enter the pupal stage of their lives (see **Insect** [The life cycle of insects]). There are many species of leafminers and they are found throughout the world.


Edward S. Ross
Leafminer larvae eat tunnels through leaves.

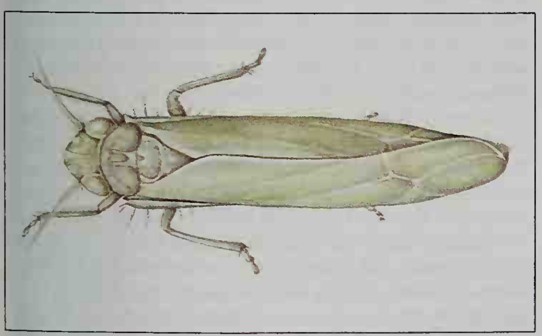
Scientific classification. Leafminers belong to the orders Coleoptera, Diptera, Hymenoptera, and Lepidoptera.

Charles V. Covell, Jr.

See also **Moth** (picture: The size of moths).

League is a measure of length in the inch-pound system of units customarily used in the United States. A *statute league* equals 3 survey miles. It also equals 15,840 survey feet, or 4.828 kilometers. A *nautical league* equals 3 international nautical miles. It also equals 18,228.346 international feet, or 5.556 kilometers.

The league dates to ancient times. The Gauls used a league equal to 1,500 Roman paces, or 2.22 kilometers. The Normans brought a league to England. At first, the English league equaled 2.4 kilometers, $1\frac{1}{2}$ times the length of the English mile. British and American sailors once used the nautical league. Today, they use the international nautical mile. Richard S. Davis


WORLD BOOK illustration by Shirley Hooper, Oxford Illustrators Limited
The leafhopper destroys plants by sucking out juices. Many leafhoppers also harm vegetation by carrying plant diseases.

See also **Foot; Mile.**

League of Nations was an international association of countries created to maintain peace among the nations of the world. The victors of World War I (1914-1918) including Britain, France, Italy, Japan, and the United States—drew up a *covenant* (constitution) for the League in 1919. President Woodrow Wilson of the United States was the chief planner of the League of Nations. The League was established in January 1920, with headquarters in Geneva, Switzerland. The organization ceased to function after World War II began in 1939. It was formally dissolved in April 1946, and the United Nations took its place.

Wilson had believed that world wars would continue to occur as long as each nation was responsible for its own defense. Under this condition, nations would form competing groups, each arming against the other. Wilson wanted the nations of the world to join together in the League of Nations, and pledge to defend the territory and independence of any member attacked by another nation. He believed that even a powerful nation, knowing it would face the united opposition of all other powerful nations, would not go to war.

Wilson got other countries to agree to his plans for the League, but he and members of the U.S. Senate differed over the terms on which the United States would join. In March 1920, the U.S. Senate rejected the Treaty of Versailles, which would have made the United States a member (see **Wilson, Woodrow** [Opposition to the League; Wilson's collapse]). Within a few years, most Americans decided there was no need to concern themselves with conflicts overseas, and the United States never did join the League of Nations.

Powers and organization

The League Covenant contained articles pledging member nations to preserve the independence and territory of all members against attack. Members agreed to submit any disputes that might lead to war either to *arbitration* (decision by a third party) or to an investigation by the League Council. They promised not to go to war with any member that agreed to the recommendations of a court of arbitration or the League Council. If any member went to war in violation of these articles, member nations agreed they would apply economic *sanctions* (penalties), such as stopping trade with the offending nation. At the League Council's request, they would also use military force against that nation.

The Council was the principal peacekeeping agency. Its size varied from 8 to 14 members during the League's history. The most powerful members of the League had permanent seats on the Council. Britain, France, Germany, Italy, Japan, and the Soviet Union held permanent seats during the years they were members of the League. The remaining seats were rotated among the small nations of the League. Recommendations of the Council had to be decided by unanimous vote.

The Assembly was composed of all member nations, and each member had one vote. The Assembly controlled the League budget, admitted new members,



Allan A. Philiba

The Palace of Nations in Geneva, Switzerland, was the headquarters of the League of Nations until the League was dissolved in 1946. The *Sphere of Nations* stands in the foreground.

The League of Nations

The following nations were the original members of the League. Many other nations joined later, and many withdrew from the League before it was disbanded in April 1946.

Argentina	France	Panama
Australia	Greece	Paraguay
Belgium	Guatemala	Peru
Bolivia	Haiti	Poland
Brazil	Honduras	Portugal
Britain	India	Romania
Canada	Iran	South Africa
Chile	Italy	Spain
China	Japan	Sweden
Colombia	Liberia	Switzerland
Cuba	Netherlands	Thailand
Czechoslovakia	New Zealand	Uruguay
Denmark	Nicaragua	Venezuela
El Salvador	Norway	Yugoslavia

elected the temporary Council members, and made amendments to the Covenant. On these matters, the Assembly could decide by a two-thirds or a majority vote. The Assembly also could discuss threats to the peace. It needed a majority vote plus the votes of all Council members to recommend on such a matter.

The Secretariat provided the administrative staff of the League. A secretary-general, who was nominated by the Council and approved by the Assembly, headed a staff of about 600 officials. These officials assisted the peacekeeping work of the League and provided personnel for special study commissions on disarmament, the protection of ethnic minorities, and colonial affairs. The Secretariat also staffed the various international organizations set up by the League to promote cooperation in international trade, finance, transportation, communication, health, and science.

The League in action

Wilson and the other statesmen who designed the League hoped it would lead nations to stop seeking protection through special alliances. Instead, they favored a system of *collective security,* in which the security of each member would be guaranteed by the protection of all. For collective security to work, it was essential that all League members—especially the most powerful ones—come to the aid of any member attacked. Neither the Council nor the Assembly could force members to help an attacked nation. Such action had to be voluntary. Each member had to believe a threat to the peace of any nation was a threat to its own peace.

Disagreement among members. The most powerful nations did not agree that collective security was the main purpose of the League. France saw the League mainly as an instrument to maintain the territorial settlement and arms restrictions imposed on Germany after World War I. The Germans resented the League because it seemed to them, too, that this was the League's real purpose. British leaders saw it as a meeting place for powerful nations to consult in the event of a threat to peace. But they did not want to commit themselves to do anything that might have threatened their security or prosperity. The Soviet Union believed the League was an imperialist fraud because Communism taught that war was inevitable among capitalist nations. During the 1930's, Japan and Italy showed their disregard for collective security by attacking member nations.

Japan withdrew from the League in 1933 because the League refused to recognize its conquest of Manchuria. Germany, admitted to the League in 1926, withdrew in 1933 because the League would not change the arms limitations imposed on Germany after World War I. An arms build-up by Germany under dictator Adolf Hitler led the Soviet Union to join the League in 1934. Italy withdrew from the League in 1937 to join Japan and Germany in an alliance against the Soviet Union. The Soviet Union was expelled in 1939 for attacking Finland.

The League achieved some success in ending armed conflicts between small nations. For example, it ended fighting between Greece and Bulgaria in 1925, and between Poland and Lithuania in 1927. But when a powerful nation was involved, the League was ineffective.

Why the League failed was most dramatically illustrated when Italy attacked Ethiopia in October 1935. The Council declared that Italy had violated the Covenant. This action obligated League members to apply economic sanctions and to consider the use of force against Italy. Members agreed to stop all imports from Italy and to send no money or war material to Italy.

But the United States, Japan, and Germany were not members. Thus, the overwhelming "community of power" that Wilson originally had in mind for use against an aggressor was reduced to three nations—Britain, France, and the Soviet Union. The other League members did not have enough power to affect Italian policy. Even so, Britain, France, and the Soviet Union would have been able to stop the Italian attack, if they had been united and determined to do so.

However, Britain and France were not willing to use force or to employ measures that might risk war. They failed to use strong economic measures, such as an oil embargo, which would have seriously hurt the Italian war effort. By May 1936, Italy had conquered Ethiopia. The League canceled its sanctions in July.

The French and British shared responsibility for the League's failure during the Ethiopian crisis. France feared that strong League action might lead Italy to join Germany in an anti-French alliance. The British feared that Italy might attack the British-controlled Suez Canal or even launch air strikes against English cities. Neither

government was prepared to face such risks. The Ethiopian case completely discredited the League as an instrument to keep peace. Gary B. Ostrower

See also International relations; Mandated territory; United Nations; Wilson, Woodrow; World War II (Nationalism).

Additional resources

Knock, Thomas J. *To End All Wars: Woodrow Wilson and the Quest for a New World Order.* Oxford, 1992.

Ostrower, Gary B. *The League of Nations from 1919-1929: An Illustrated History and Chronology of the First Ten Years of the League of Nations.* Avery Pub., 1996.

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League of United Latin American Citizens is an organization of Spanish-speaking peoples in the United States. The group, known as LULAC, encourages patriotism and works to protect members' rights.

LULAC has educational centers that offer counseling on admission and financial aid to young people who want to attend college. The league endorses political candidates and organizes voter registration drives. It also provides legal assistance to fight discrimination through court action. Local councils sponsor holiday parades and fiestas to preserve Latin American culture.

LULAC was founded in 1929 in Corpus Christi, Texas. Its headquarters are in Phoenix. Feliciano M. Ribera

League of Women Voters is a nonpartisan organization in the United States that promotes informed, active public participation in government. Both men and women may belong to the league. The league encourages eligible Americans to register and vote, and it provides information on candidates before elections. It does not endorse candidates or political parties. The league formed in 1920. Its headquarters are in Washington, D.C.

Critically reviewed by the League of Women Voters

See also Catt, Carrie Chapman; Woman suffrage.

Leakey, Louis Seymour Bazett (1903-1972), was a British anthropologist who convinced scientists that Africa was the most important place to search for evidence of the earliest human beings. Scientists had previously centered their searches in Asia because of fossils discovered in China and Java (now part of Indonesia).

Leakey led fossil-hunting expeditions in eastern Africa during the 1920's. He married Mary D. Nicol in 1936, and she joined in his work. The couple discovered fossils of apelike animals that lived between 14 million and 20 million years ago in what is now Kenya. In the early 1960's, a Leakey expedition to the Olduvai Gorge, Tanzania, uncovered human fossils. Leakey and other scientists named the discovery *Homo habilis,* a fossil group now considered by most anthropologists to be the remains of one of the earliest types of human beings. *Homo habilis* lived in Africa about 2 million years ago.

Leakey was born in Kabete, Kenya, near Nairobi. His parents were British missionaries. Alan E. Mann

See also Homo habilis; Prehistoric people.

Leakey, Mary Douglas (1913-1996), was a British archaeologist and anthropologist who found fossils, tools, and other evidence of prehistoric human beings in Africa. She recorded 1,600 prehistoric rock paintings and described the development of early stone tools. In 1959, Leakey found the skull of a humanlike creature at Olduvai Gorge, Tanzania. This creature, first named *Zinjanthropus* but now called *Australopithecus boisei,* lived about 1,750,000 years ago. Its discovery proved that humanlike creatures called *australopithecines* lived in eastern Africa. In 1978, Leakey found footprints preserved in hardened volcanic ash at Laetoli, Tanzania. The prints, dating from 3,600,000 years ago, suggested that humanlike creatures had begun walking upright by then. Mary Douglas Nicol was born in London. She married British anthropologist Louis Leakey in 1936. Alan E. Mann

See also Australopithecus; Prehistoric people.

Leakey, Meave Gillian, *meev* (1942-), is a British-born zoologist and paleontologist who helped identify some of the oldest known humanlike fossils. In 1994 and 1995, scientists led by Leakey and anthropologist Alan Walker of the United States found prehistoric fossils near Lake Turkana, Kenya. They identified the fossils as *Australopithecus anamensis,* humanlike creatures that lived about 4 million years ago. These fossils may belong to one of the earliest *hominid* (humanlike) species.

In 2001, Leakey announced that Kenyan fossil hunters on her team had discovered pieces of a hominid skull that were about 3,500,000 years old. The skull appeared to be that of a previously unknown type of hominid. Leakey classified the skull as a new genus and species called *Kenyanthropus platyops.* Unlike other hominid fossils about the same age, such as those of *A. afarensis,* this skull has a much flatter face and smaller molars. Some paleontologists think this new species may be an early, direct ancestor of human beings.

Meave G. Epps was born in London. In 1965, British anthropologist Louis Leakey hired her to study monkeys and apes in Kenya. In 1969, Epps joined a fossil-hunting team led by Louis's son, Richard, an important Kenyan scientist. She married Richard in 1971. Alan E. Mann

See also Australopithecus; Prehistoric people.

Leakey, Richard Erskine Frere (1944-), is a Kenyan scientist who discovered many prehistoric human fossils at Lake Turkana, Kenya. In 1969, for example, he discovered a nearly complete skull of a humanlike creature that belonged to the species *Australopithecus boisei.* The skull was about 1,750,000 years old.

In 1972, a Kenyan fossil hunter on Leakey's team named Bernard Ngeneo found pieces of a skull that were about 1,900,000 years old. The pieces are among the earliest human fossils ever found, but scientists are unsure whether to classify them in the species *Homo habilis* or in the species *Homo rudolfensis.* In 1984, another Kenyan member of Leakey's team, Kamoya Kimeu, found an almost complete human skeleton that dates from about 1,600,000 years ago. Some scientists believe the skeleton belongs to the species *Homo erectus.* Others think *Homo erectus* lived only in Asia and that the skeleton belongs to the species *Homo ergaster.*

Leakey was born in Nairobi, Kenya. He directed the National Museums of Kenya from 1968 to 1989. From 1990 to 1994, and again in 1998, he headed the Kenya Wildlife Service. In that position, he worked to eliminate the illegal killing of elephants for their tusks, a source of ivory. In 1995, Leakey helped found a Kenyan political party called Safina. From 1999 to 2001, he headed the Kenya Civil Service. He is the son of distinguished British anthropologists Louis and Mary Leakey. Alan E. Mann

See also Australopithecus; Homo erectus; Homo habilis; Prehistoric people.

Lean, David (1908-1991), was a highly acclaimed English motion-picture director. He won Academy Awards as best director for *The Bridge on the River Kwai* (1957) and *Lawrence of Arabia* (1962).

Lean was born in Croydon. He began his motion-picture career in London at the age of 19. He performed a variety of duties before becoming a successful film editor in the mid-1930's. Lean made his debut as a director in *In Which We Serve* (1942), which he co-directed with English playwright Noël Coward. The movie won praise for its portrayal of the heroism of British sailors during World War II (1939-1945).

Lean directed two popular movies adapted from the novels of English author Charles Dickens, *Great Expectations* (1946) and *Oliver Twist* (1948). He also directed the comedy *Blithe Spirit* (1945), the love stories *Brief Encounter* (1945) and *Summertime* (1955), the Russian epic *Dr. Zhivago* (1965), and the Asian drama *A Passage to India* (1984). Queen Elizabeth II knighted Lean in 1984, and he became known as Sir David Lean. John F. Mariani

Leander. See **Hero and Leander.**

Leaning Tower of Pisa is a bell tower at Pisa, Italy. It is famous for leaning 14 $\frac{1}{2}$ feet (4.4 meters) out of line when measured from the seventh story. It inclines because its foundation was built on unstable soil. Construction began in 1173 and ended between 1360 and 1370. The ground underneath the tower first started to sink after the first three stories were completed.

The tower, or *campanile,* is part of a complex of three buildings—a baptistery, a church, and the bell tower. Together the three structures form the Cathedral of Pisa, one of the world's most beautiful building groups. While most cathedrals in Europe combine the baptistery, church, and tower in a single building, the Italians frequently separated them, as at Pisa. Built during the Romanesque period, the three buildings are noted for their colorful marble and decorative arches.

The tower is 51 feet (15.5 meters) in diameter and about 180 feet (55 meters) tall. The walls are 13 feet (4 meters) thick at the base and from 6 to 7 feet (1.8 to 2.1 meters) thick at the top. Fifteen arches surround the tower on the ground floor, and 30 arches encircle each of the next six stories. The top story, which houses the bells, has 12 arches. An inner staircase of almost 300 steps leads to the top. In 1990, the tower was closed for repairs. At that time, its lean had been increasing an average of $\frac{1}{20}$ of an inch (1.3 millimeters) per year. Engineers stabilized the tower's foundation and straightened it about 15 inches (38 centimeters) to prevent it from eventually collapsing. The tower was reopened to the public in 2001.

According to legend, the Italian physicist Galileo made his famous experiments with falling weights in 1589 from the top of the tower. But many scientists no longer believe this story. J. William Rudd

Leap year has 366 days, or one more day than an ordinary year. A leap year occurs in every year that can be divided evenly by four, except the years that mark the even hundreds, such as 1500. The only century years that are leap years are those that can be divided evenly by 400, such as 1600 and 2000. Leap years were added to the calendar to make the calendar year nearly the same as the solar year, which is the time it takes for the sun to pass the vernal equinox twice. The extra day of the leap year occurs as February 29 once every four years. See also **Year.** James Jespersen

Lear, Edward (1812-1888), an English writer and artist, became famous for his humorous poems for children. His first book of poems, *A Book of Nonsense* (1846), is a masterpiece of children's literature. His best-known poem, "The Owl and the Pussy-Cat" (1871), is also a classic. Lear became noted for his short rhymed verses called *limericks.* For an example, see **Limerick.**

Lear was born in London. He began to earn his living at the age of 15 by drawing birds and doing other artwork. Lear established a reputation as a natural-history artist with his first book of drawings of parrots, published in 1832. He also became known for his detailed landscape paintings. In the mid-1830's, Lear began to write nonsense verse for children. However, none of his verses was published until 1846. Lear also drew many illustrations for his books. Sharon Bassett

Learning is an important field of study in psychology. Psychologists define learning as the process by which changes in behavior result from experience or practice. By *behavior,* psychologists mean any response that an organism makes to its environment. Thus, behavior includes actions, emotions, thoughts, and the responses of muscles and glands. Learning can produce changes in any of these forms of behavior.



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The Leaning Tower of Pisa was built as a bell tower for the Pisa Cathedral, *left.* The tower, constructed from 1173 to about 1370, leans because its foundation lies on a layer of unstable subsoil made up of a mixture of sand, clay, and water.

Not all changes in behavior are the result of learning. Some changes result from *maturation* (physical growth). Others, including those caused by illness or fatigue, are only temporary and cannot be called learning.

How we learn

We can see learning taking place all the time, but there is no simple explanation of the process. Psychologists have examined four kinds of learning in detail: (1) classical conditioning or respondent learning, (2) instrumental conditioning or operant learning, (3) multiple-response learning, and (4) insight learning.

Classical conditioning is based on stimulus-response relationships. A *stimulus* is an object or a situation that excites one of our sense organs. A light is a stimulus because it excites the retina of the eye, allowing us to see. Often a stimulus makes a person *respond* in a certain way, as when a flash of light makes us blink. Psychologists say that in this instance the stimulus *elicits* (draws forth) the response.

In classical conditioning, learning occurs when a new stimulus begins to elicit behavior similar to that originally produced by an old stimulus. For example, suppose a person tastes some lemon juice, which makes the person salivate. While the person is tasting it, a tone is sounded. Suppose these two stimuli—the lemon juice and the tone—occur together many times. Eventually, the tone by itself will make the person salivate. Classical conditioning has occurred because the new stimulus (the tone) has begun to elicit the response of salivation in much the same way as the lemon juice elicited it.

Any condition that makes learning occur is said to *reinforce* the learning. When a person learns to salivate to a tone, the reinforcement is the lemon juice that the tone is paired with. Without the lemon juice, the person would not learn to salivate to the tone.

The classical conditioning process is particularly important in understanding how we learn emotional behavior. When we develop a new fear, for example, we learn to fear a stimulus that has been combined with some other frightening stimulus.

Studies of classical conditioning are based on experiments performed in the early 1900's by the Russian physiologist Ivan P. Pavlov. He trained dogs to salivate to such signals as lights, tones, or buzzers by presenting these signals when he gave food to the dog (see **Reflex action**). Pavlov called the learned response a *conditioned response* because it depended on the conditions of the stimulus. To emphasize the fact that a stimulus produces a response in this kind of learning, classical conditioning is often called *respondent learning.*

Instrumental conditioning. Often a person learns to perform a response as a result of what happens after the response is made. For example, a child may learn to beg for candy. There is no one stimulus that elicits the response of begging. The child begs because such behavior occasionally results in receiving candy. Every time the child receives candy, the tendency to beg becomes greater. Candy, therefore, is the reinforcer. Instrumental conditioning is also called *operant conditioning* because the learned response *operates* on the environment to produce some effect.

The American psychologist B. F. Skinner performed important experiments with instrumental conditioning in the 1930's. He trained rats to press levers to get food. In one experiment, a hungry rat was placed in a special box containing a lever attached to some concealed food. At first, the rat ran around restlessly. Eventually, it happened to press the lever, and the food dropped into the box. The food reinforced the response of pressing the lever. After repeating the process many times, the rat learned to press the lever for food.

Skinner's experiments were based on those performed earlier in the 1900's by the American psychologist E. L. Thorndike. In Thorndike's experiments, an animal inside a puzzle box had to pull a string, press a pedal, or make some other response that would open the box and expose some food. Thorndike noted that the animal learned slowly and gradually. He called this type of learning *trial-and-error behavior.*

Multiple-response learning. When we learn skills, we first learn a sequence of simple movement-patterns. We combine these movement-patterns to form a more complicated behavior pattern. In most cases, various stimuli guide the process. For example, operating a typewriter requires putting together many skilled finger movements. These movements are guided by the letters or words that we want to type. At first, a person has to type letter by letter. With practice, the person learns to type word by word or phrase by phrase. In verbal learning, such as memorizing a poem or learning a new language, we learn sequences of words. We then combine these sequences of responses into a complex organization. Learning that involves many responses requires much practice to smooth out the rough spots.

To examine this kind of learning, psychologists have observed animals learning to run through a maze. Starting at the beginning, the animal wanders through the maze until it finds food at the end. The animal periodically comes to a choice-point, where it must turn right or left. Only one choice is correct. Eventually the animal learns the correct sequence of turns. Psychologists have found that the two ends of the maze are learned more easily than the parts near the middle. In the same way, when we learn a list of things, we usually find the beginning and end easier than the middle.

Insight learning. The term *insight* refers to solving a problem through understanding the relationships of various parts of the problem. Insight often occurs suddenly, such as when a person looks at a certain problem for some time and then suddenly grasps its solution.

The psychologist Wolfgang Köhler performed important insight experiments in the early 1900's. He showed that chimpanzees sometimes use insight instead of trial-and-error responses to solve problems. When a banana was placed high out of reach, the animals discovered that they could stack boxes on top of each other to reach it. They also discovered how to put two sticks together to reach an object that was too far away to reach with one stick. The chimpanzees appeared both to see and to use the relationships involved in reaching their goals.

Theories of learning are based on facts obtained from experiments such as those on classical and instrumental conditioning. Psychologists differ in their interpretation of these facts. As a result, there are a number of learning theories. These theories can be divided into three groups.

One group of psychologists emphasizes stimulus-response relationships and has performed experiments with classical and instrumental conditioning. They say all learning is the forming of habits. When we learn, we connect a stimulus and a response that did not exist before, thus forming a habit (see **Habit**). Habits can range from the simplest ones to complex ones that are involved in learning skills. These psychologists believe that when we meet a new problem, we use appropriate responses learned from past experience to solve it. If this procedure does not lead to the solution, we use a trial-and-error approach. We use one response after another until we solve the problem. The stimulus-response approach has been used to explain and modify bad habits. For example, when a person is irrationally afraid of dogs, methods called *behavior modification* can be used to replace the fear response to a dog with a more relaxed response.

A second group of psychologists stresses *cognition* (the act of knowing) above the importance of habit. These experts feel that experiments with classical and instrumental conditioning are too limited to explain such complex learning as understanding concepts and ideas. This approach emphasizes the importance of the learner's discovering and perceiving new relationships and achieving insight and understanding.

A third group of psychologists has developed *humanistic* theories. According to these theories, much human learning results from the need to express creativity. Almost any activity, including athletics, business dealings, and homemaking, can serve as a creative outlet. The psychologists in this group believe that each person must become involved in challenging activities—and must do reasonably well at them—to have a satisfying life. The individual gains a sense of control, growth, and knowledge from such activities. For learning to occur, people must feel free to make their own decisions. They also must feel worthy, relatively free from anxiety, self-respecting, and respected by others. Under these conditions, their own inner drives will lead them to learn. Some kinds of group therapy try to provide an accepting, supporting environment. Such an environment is intended to increase people's awareness of their own thoughts and of the world around them.

Learning involves changes in the nervous system. Scientists are trying to discover the processes that take place in the brain to produce learning. Such research may lead to a physiological theory of learning.

Efficient learning

Readiness to learn. Learning occurs more efficiently if a person is ready to learn. This readiness results from a combination of growth and experience. Children cannot learn to read until their eyes and nervous systems are mature enough. They also must have a sufficient background of spoken words and prereading experience with letters and pictures.

Motivation. Psychologists and educators also recognize that learning is best when the learner is motivated to learn (see **Motivation**). External rewards are often used to increase motivation to learn. Motivation aroused by external rewards is called *extrinsic motivation.* In other cases, people are motivated simply by the satisfaction of learning. Motivation that results from such satisfaction is called *intrinsic motivation.* This type of motivation can be even more powerful than extrinsic motivation. Punishment, particularly the threat of punishment, is also used to control learning. Experiments have shown that intrinsic and extrinsic rewards serve as more effective aids to learning than punishment does. This is due largely to two factors: (1) learners can recognize the direct effects of reward more easily than they can the effects of punishment; and (2) the by-products of reward are more favorable. For example, reward leads to liking the rewarded task, but punishment leads to dislike of the punished deed.

Psychologists also look at the motivation of learning from the point of view of the learner. They tend to talk about success and failure, rather than reward and punishment. Success consists of reaching a goal that learners set for themselves. Failure consists of not reaching the goal. An ideal learning situation is one in which learners set progressively more difficult goals for themselves, and keep at the task until they succeed.

Skill learning and verbal learning. Through research, psychologists have discovered some general rules designed to help a person learn.

The following rules apply particularly to learning skills. (1) Within a given amount of practice time, you can usually learn a task more easily if you work in short practice sessions spaced widely apart, instead of longer sessions held closer together. (2) You can learn many tasks best by imitating experts. (3) You should perform a new activity yourself, rather than merely watch or listen to someone. (4) You learn better if you know immediately how good your performance was. (5) You should practice difficult parts of a task separately and then try to incorporate them into the task as a whole.

Two additional rules apply mainly to verbal learning. (1) The more meaningful the task, the more easily it is learned. You will find a task easier to learn if you can relate it to other things you have learned. (2) A part of a task is learned faster when it is distinctive. When studying a book, for example, underlining a difficult passage in red makes the passage distinctive and easier to learn.

Transfer of training. Psychologists and educators recognize that new learning can profit from old learning because learning one thing helps in learning something else. This process is called *transfer of training.*

Transfer of training can be either positive or negative. Suppose a person learns two tasks. After learning Task 1, the person might find Task 2 easier or harder. If Task 2 is easier, then the old learning has been a help and positive transfer of training has occurred. If Task 2 is harder, the old learning is a hindrance and negative transfer has occurred.

Whether transfer is positive or negative depends on the relationship between the two tasks. Positive transfer occurs when the two tasks have similar stimuli and both stimuli elicit the same response. For example, if we know the German word *gross,* it is easier to learn the French word *gros* because both words mean *large.* In this case, similar stimuli (*gross* and *gros*) elicit the same response (*large*).

Negative transfer occurs when the two tasks have similar stimuli, which elicit different responses. After you learn the German word *Gras* (grass), it is harder to learn the French word *gras* (fat). The words are similar,

but they have different meanings. In this case, similar stimuli *(Gras* and *gras)* elicit different responses.

Psychologists believe new learning can profit from old learning because of three factors: (1) positive transfer of training, (2) general principles that we learn in one task and apply to another task, and (3) good study habits that we learn in one task which help us learn another task. Leonard M. Horowitz

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Developmental psychology	Piaget, Jean
Educational psychology	Psychology (History)
Instinct	Skinner, B. F.
Köhler, Wolfgang	Testing
Learning disabilities	Thorndike, Edward L.

Additional resources

Banner, James M., Jr., and Cannon, H. C. *The Elements of Learning.* Yale, 1999.
Levine, Melvin D. *A Mind at a Time.* Simon & Schuster, 2002. Discusses several ways people learn.

Learning disabilities are disorders that damage a child's ability to learn. Children with learning disabilities may have average or above-average intelligence, and they also have normal hearing and vision. But they apparently cannot use information transmitted by the senses to the brain as accurately as most other children can. Therefore, they do poorly in school, or not as well as they might.

Learning disabilities can interfere with the development of such basic skills as concentration, coordination, language, and memory. Some children with learning disabilities have more than the usual difficulty speaking, understanding spoken language, or paying attention in class. Others have difficulty learning to read, spell, or solve arithmetic problems.

In the United States, from 10 to 15 percent of all children between the ages of 5 and 17 have one or more learning disabilities. Early diagnosis and treatment are important because specialized teaching techniques can help many of these students overcome their disabilities and succeed in school. Learning problems may continue into adulthood unless a child receives help.

Causes. Physicians cannot always discover the specific cause of a child's learning disability. But scientists believe that most learning disabilities result from minor damage to the brain or to major nerves leading to the brain. For example, illness or poor nutrition in a pregnant woman can injure the brain tissue and nervous system of her unborn child. The use of drugs, tobacco, or alcohol during pregnancy may also contribute to the development of learning disabilities. Brain damage can occur at birth if the baby's brain does not receive enough oxygen. Such damage can take place during a long, difficult birth or if the mother receives an overdose of a painkilling drug. A child also may inherit a learning disability.

Many other factors may increase a child's chances of developing a learning disability. An imbalance of certain chemicals in the body or a lack of nutritious foods can delay or permanently damage the development of the nervous system. Medical research suggests that certain chemicals, especially lead used in paint, may trigger learning disabilities in some children.

Even a child with no physical problem may develop a learning disability. Disabilities can result from a lack of the early learning experiences that stimulate mental growth and development. These experiences include hearing language and manipulating objects.

Types. There are many types of learning disabilities. For example, *perceptual disorders* hinder the brain's ability to organize and interpret sights and sounds. Children with a perceptual disorder may be unable to pinpoint where one word ends and another begins on a page. In addition, children with a perceptual disorder may not be able to distinguish between words that sound somewhat alike. Perceptual disorders make learning to speak and read difficult.

Another type of learning disability affects memory. Children with this problem cannot easily recall what familiar objects look like or what sounds the objects make. They may not be able to learn a sequence, such as the alphabet or a telephone number.

Other learning disabilities interfere with the ability to behave properly and to concentrate. Disabilities that affect a child's concentration are known as *attention deficit disorders. Distractible* children daydream almost constantly. They cannot direct their attention to any topic for more than a few minutes. In contrast, children with a disability called *perseveration* cannot easily shift their attention from one activity to another. They may continue working at a task long after it has been finished. *Hyperactive,* or *hyperkinetic,* children cannot sit still. These children speak and act on impulse and tend to become impatient and boisterous in the classroom. A child with *emotional lability* has changes in mood for no apparent reason.

An *orientation-related disability* damages a child's sense of direction, distance, and space. Individuals with this problem may be unaware of where they are and feel lost even in familiar surroundings. They cannot distinguish left from right or up from down. They become poor readers because they cannot remember to read from left to right. They also may not recognize the difference between letters that resemble each other, such as *b* and *d.*

Other types of learning disabilities interfere with effective muscle control and can cause clumsiness and loss of balance. Some of these disabilities prevent specific movements necessary for certain activities. For example, *dyspraxia* is the inability to properly move the lips, tongue, and other parts of the body in speech. *Dysgraphia* affects the brain's control of the small finger muscles used in writing.

Learning disabilities that block the development of language skills are called *psycholinguistic disabilities.* One such condition, called *dysphasia,* interferes with the ability to produce or understand human speech. *Dyslexia* damages a child's capacity to understand printed or written words. Learning problems that hinder a child's progress in particular subjects, such as arithmetic or spelling, are *specific learning disabilities.*

Disorders called *nonverbal learning disabilities* interfere with a child's ability to understand the facial expressions and other gestures of other people. These disabilities can make it difficult for a child to get along with

others, or they may cause the child to behave inappropriately.

Diagnosis and treatment. Not all learning and behavioral problems are caused by learning disabilities. Parents who suspect that their son or daughter may have a learning disability should have the child examined by a team of specialists. Many school districts provide such testing free or at a reasonable cost. Tests by a *pediatrician* (children's doctor), eye and ear specialists, a psychiatrist, and a social worker may find other possible causes of the problem. Such causes include emotional disturbances, mental retardation, and poor hearing and vision. If the test results are normal, a physician called a *neurologist* should examine the child for evidence of damage to the brain or nervous system. Then a psychologist should test each of the child's learning processes to determine which ones have been affected. Finally, a special-education teacher must measure the child's school achievement to learn in which subjects he or she needs special help.

The method of treatment suggested by the teacher depends on the type and extent of the disability. Some learning-disabled children learn best in special classes with others who have similar problems. But many youngsters can do exercises to improve their weak skills in classes with nonhandicapped children. The use of medication has helped many children who have attention deficit disorders. Some learning experts suggest more controversial treatments for learning disabilities, including biofeedback, special diets, and exercises (see **Biofeedback**). Special counseling is often helpful for families that include children with learning disabilities. Such counseling increases the families' ability to understand the children and to help the children deal with the stress that they experience in school as a result of their disorders. Dianne Shields

See also **Attention deficit disorder; Dyslexia; Occupational therapy** (Helping people with mental illness).

Additional resources

Lauren, Jill. *Succeeding with LD: 20 True Stories about Real People with LD (Learning Differences).* Free Spirit, 1997. Younger readers.

Ross, Linda M., ed. *Learning Disabilities Sourcebook.* Omnigraphics, 1998.

Smith, Corinne, and Strick, Lisa. *Learning Disabilities A to Z.* Free Pr., 1997.

Lease is an agreement that gives one person or company the right to possess property owned by another person or company. The possession lasts for a fixed period of time, called a *term.* Terms range from a few hours to many years. Items commonly leased include real estate, automobiles, videotapes, and office equipment. The owner of the property is called the *lessor* or *landlord.* The person receiving the property is called the *lessee* or *tenant.* Most lessees promise to pay *rent* to the lessor.

Modern law often views a lease as a contract. If one party *breaches* (violates) a promise included in the lease, the other party may ask a court to force the breaching party to perform the promise, to pay money for damage caused by the breach, or to end the lease early.

Leases are either written or unwritten. Most states in the United States require that a lease be written if its term is longer than one year. The lease describes the property being leased, the term, the rent, and any other promises or conditions. The lessee and lessor each may agree to pay certain expenses, such as utility bills or maintenance costs. Also the lessor may agree to keep the property safe from intruders. In some cases, unwritten promises are implied by law. For example, courts and laws in many states assume that a landlord must ensure that residential property is fit to live in.

During the lease term, both the lessor and lessee own rights in the property. While the lessee has the right to possess and use the property, the lessor is entitled to protection of the property. If the lessee harms the property, a court may order the lessee to pay for repair and to refrain from further damage. The court may also permit the lessor to end the lease early. James L. Winokur

See also **Contract; Fixture; Tenant.**

Lease, Mary Elizabeth (1850-1933), was an American orator and reformer. She helped establish the Populist Party, a national political party (see **Populism**).

Lease was born in Ridgway, Pennsylvania. She moved to Kansas in 1870 and became active in the Farmers' Alliance movement there. Debt-ridden Midwestern farmers established the movement to protest against bank and railroad monopolies, and Lease voiced their complaints. In 1891 and 1892, she worked with the Farmers' Alliance, the Knights of Labor, and other groups to form the Populist Party. Lease seconded the nomination of James B. Weaver for president at the party's nominating convention in 1892 and he became the Populist presidential candidate. Lease urged Populist programs like government ownership of railroads and free coinage of silver (see **Free silver**).



Brown Brothers

Mary Elizabeth Lease

Lease left the Populist Party in 1896 because it supported William Jennings Bryan, the Democratic candidate for president. She continued to work for women's *suffrage* (right to vote) and other reforms. Lease discussed her views on politics and reform in her book *The Problem of Civilization Solved* (1895). Nancy Woloch

Leather is a tough, flexible material made from the skin of animals. Cattle hides provide the source of most leathers, but deer, goat, pig, and sheep skins are also widely used. Specialty leathers are made from alligator, shark, and snake hides. The process of turning the animal skin into a leather product that can be made into useful objects is called *tanning.*

Leather is used to make shoes, boots, belts, gloves, jackets, hats, shirts, trousers, skirts, purses, and many other objects. Baseballs, basketballs, and footballs have leather covers. Industries use drive belts made from leather, and automobiles, trucks, and buses run on bearings protected by leather seals.

Leather is strong and durable. It can be made as flexible as cloth or as stiff as wood. Some kinds of leather are thick and heavy, but others are thin. Leather can be dyed, polished until it has a glossy finish, or *embossed*



WORLD BOOK photo by Ralph Brunke

Leather is used to make a wide variety of products. The type of leather used depends on the product. This photo shows a purse made of *chrome-tanned leather,* shoes made of highly polished, glossy *patent leather,* a hat made of soft leather called *suede,* and a polishing cloth made of clothlike *chamois.*

(decorated with raised figures).

People have known how to make leather since prehistoric times. Some tanning methods that were developed by the ancient Greeks and Romans are still in use. Today, the United States is one of the world's largest producers of leather. New York, Massachusetts, California, and Wisconsin are the country's leading leather-producing states.

Kinds of leather

The chief kinds of leather are *shoe sole leather, shoe upper leather, chamois,* and *suede.* Shoe sole leather is produced from the thick skins of cattle and other large animals. Shoe upper leather is obtained from the thinner skins of calves, goats, and other smaller animals or by splitting heavy hides into thin layers. About 80 per cent of all tanned leather is made into shoes.

Chamois leather was originally made from the chamois, an animal that resembles the antelope. But today, most chamois leather is made from split sheepskin. Properly tanned chamois leather is as soft as cloth and will hold water like cloth. Chamois leather is often used as a washing and polishing cloth.

Suede leather is often made from the inside flesh layer of a cowhide that has been split. In the past, goatskins or sheepskins were used for this leather. Suede is soft, flexible, warm, and water-resistant. This kind of leather is used to make jackets, coats, dresses, pants, and shoe uppers.

How leather is made

Preparing the hides. Before animal hides can be tanned, they must undergo certain preparations. These preparations include (1) curing, (2) fleshing, (3) unhairing, and (4) bating.

Curing. Most animal hides used to make leather come from a meat packer or slaughterhouse. Many of the skins used in the United States are imported.

The skins are cured before they go to the tannery to keep them from rotting. Hides are cured by applying salt to the flesh side of the skin, by soaking them in *brine* (salty water), by partly drying and salting them, or by just drying them. After they are cured, the skins are stacked in revolving drums filled with water. The water removes dirt and blood, washes out most of the salt, and replaces moisture lost in the curing process.

Fleshing. After the skins are washed and remoisturized, they are fleshed. Workers run the hides across a fleshing machine equipped with sharp knives, removing all fat and meat on the flesh side of the skin. More and more hides are being fleshed at the packing house, thereby eliminating the fleshing step at the tannery.

Unhairing. Workers put the fleshed hides in vats containing a lime and water solution that has a small amount of sodium sulfide. The solution weakens the hair roots, and in a few days the hair is loose. The hides are then run through a machine that scrapes the hair away. The hair is kept for use in making felt and other products. After unhairing, the hides are refleshed to remove bits of fat loosened by the unhairing process. Then, they are washed in clean water.

Bating. After unhairing, the skins are bated—that is, they are placed in a mild acid bath to neutralize the unhairing solutions left in them. This process is necessary because the solutions used for tanning are acidic. If the alkaline solutions used for unhairing were not neutralized in this way, they could prevent the tanning solutions from penetrating the skin. Enzymes are also added to the bath to digest soluble proteins in the hide that could interfere with the tanning process.

Tanning. After the hides have been cured, fleshed, unhaired, and bated, they are ready for tanning. There are four chief methods of tanning hides: (1) vegetable tanning, (2) chrome tanning, (3) combination tanning, and (4) oil tanning.

Vegetable tanning is generally carried out in large vats filled with tanning solutions, which are made from water and *tannin.* Tannin is a bitter substance that is obtained from such plants as the chestnut, hemlock, mangrove, oak, and quebracho trees.

Workers increase the strength of the tanning solution in proportion to the time the hide is left in the solution. Tanning solutions commonly start at about 0.5 per cent tannin and are increased to as much as 25 per cent tannin by the completion of the tanning process. Vegetable tanning usually takes from one to three months, but thick skins are sometimes tanned for a year.

Vegetable-tanned leather is firmer and more water-resistant than chrome-tanned leather. Vegetable-tanned leather may be *stuffed*—that is, materials such as fats and oils may be worked into it. Stuffing makes the leather water-repellant and more resistant to wear. Vegetable-tanned leather is made into bookbindings and heavy belts for machinery. Pure vegetable tanning is also used for such specialty leathers as *basil,* made from sheepskin; some pigskin; and buffalo, ostrich, rhinoceros, and walrus hides.

Chrome tanning is the most widely used mineral tanning process. It is performed with a tanning solution of *chrome salts* (compounds of chromium). Before skins are chrome tanned, they are *pickled* (soaked in a solution of sulfuric acid and salt). The skins are soaked until their acidic content reaches a predetermined level. Then they are removed and washed. After washing the skins, workers place them in tanning drums filled with water and chromium sulfate. This solution tans the skins and also gives them a light blue color. The skins are usually completely tanned in a few hours.

Chrome-tanned leather can be made much faster than vegetable-tanned leather. It is also more resistant to heat and scratching, more flexible, and easier to soften. Leather for shoe uppers, gloves, wallets, luggage, and upholstery is generally chrome tanned. However, some of these leathers are retanned with *syntans* (synthetic tanning materials), vegetable-tanning solutions, or substances containing formaldehyde, to give them special characteristics.

Combination tanning involves the use of both the chrome-tanning and vegetable-tanning methods. Combination tanning is used for leathers with special qualities, such as extremely soft garment, glove, or shoe upper leathers. In today's tanneries, most leather is chrome tanned, either as the complete tanning process, or as a *pretan* for vegetable tanning. Pretanning speeds up the vegetable-tanning process and also gives vegetable-tanned leather more flexibility. Some shoe soles are vegetable tanned, but usually they are pretanned with a chrome tan.

Oil tanning is used for the chamois leather that is made from sheepskin. First the wool is removed from the sheepskin and the skin is split into layers. The flesh *split* (side) is used for chamois, and workers begin by shaving the split to remove the fat cells. Next, they put the shaved split into a machine that hammers cod-liver oil into the skin. After the oil has penetrated it, the skin is removed from the machine and dried. It is then buffed to soften it and to give it a *nap* (soft, woolly surface). Saddle leather and leather seals used on some machinery are also oil tanned. However, they are pretanned with chrome before being oil tanned.

Final processing that is carried out after the skins are tanned includes (1) splitting, (2) dyeing, (3) staking, and (4) finishing.

Splitting. The tanned skins are removed from the tanning materials and dried. Some are then split by a machine that cuts the skins into two layers. The top layer is called *top grain.* The bottom, or flesh, layer is often called *suede leather.* The skin is further divided into four sections. The *bend* section is the skin on either side of the backbone from the rump to the shoulder. The bend section provides the finest leather. The *shoulder* section is also fine leather, but it often is wrinkled. The *head* section is good leather, but the pieces are small and uneven. The *belly* section is poorest in quality because it is uneven and tends to stretch.

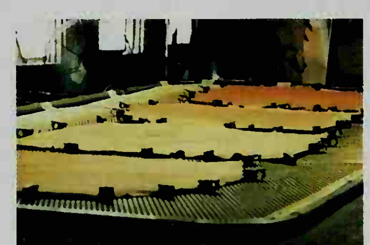
Dyeing. Almost all leather is dyed after tanning. Dyeing is often done in large drums similar to those used in chrome tanning. Leather can be dyed with a number of aniline dyes, natural wood dyes, acid dyes, and even some tanning agents. The dyeing takes place while the skin is being tumbled with a mixture of warm water and the dyeing material. Oil is usually added to further soften the skin. This process is called *fat-liquoring.* After the hide is dyed and fat-liquored, it is dried in drying vats, by pasting the hide onto a glass plate or a metal sheet. The hide may also be dried by *toggling* (pinning) it to a large wooden sheet with holes in it.

Staking. Some leather must be made softer after it is dyed. The dried skin is partially remoisturized by putting it in a room with a highly humid atmosphere, or by covering it with damp sawdust or a similar material. Then it is put on a staking machine, where steel pegs stretch

How leather is made



Tanning begins as workers place the animal hides in a solution of certain chemicals and water. The solution loosens the hair on the hides.



Leather is dried following the tanning process. In one drying method, the leather is stretched on large wooden *toggling frames* that have holes in them.



Some leather is split into layers by a splitting machine. Workers measure the thickness of the layers with a special gauge.



Dry milling is one of several methods used to soften leather. In this method, workers place the leather in large drums and then tumble it for hours.



A seasoning machine smooths the surface of the leather. The rollers apply such seasoning materials as pigments, shellacs, and waxes.



Cromwell Leather Company, Inc.

Finishing includes spraying the leather with such substances as proteins, waxes, and oils. The spraying machine above is activated by a computer.





Field Museum of Natural History



The Metropolitan Museum of Art, Gift of Gustavus A. Pfeiffer, 1948

Leather from the past has often survived in good condition because of its durable quality. The leather sandals from ancient Egypt, *far left,* are about 2,000 years old. The Spanish leather gameboard and box, *left,* was probably made in the 1700's.

and work the leather to soften it. If extremely soft leather is desired, it is tumbled in wooden drums. Glove leather is often softened in this way.

Finishing. After staking, the leather is ready for the final finishing process. *Casein* (a protein found in milk), other substances obtained from blood and milk, waxes, and oils are some of the materials used for a final finish on leather. The finish is sprayed on in layers. Between applications, a cylindrical piece of glass or steel is rolled over the leather to smooth and glaze it. The most highly polished leather is called *patent leather.* It is produced by applying successive coats of heavy oil varnish at the end of the finishing process. This varnish gives patent leather a high, durable gloss.

History

People have tanned animal skins since prehistoric times. The ancient Egyptians made such durable leather that specimens over 3,000 years old have been discovered in almost perfect condition. Evidence of oil tanning has been found in leather from Egyptian tombs. The early Greeks and Romans also made contributions to the science of leathermaking. Some of their methods are still in use today.

Many ancient peoples tanned their leather by placing layers of bark, leaves, and fruit over hides and adding water. This process took months, and in the case of thick skins, even years. As early as 800 B.C., people discovered the mineral salt alum and began using it as a tanning agent. The Assyrians, Babylonians, Greeks, and Sumerians used this mineral method of tanning because it was much faster than previous techniques.

The American Indians used deerskins to make leather for their moccasins, cloaks, and tents. Colonial settlers refined the leathermaking process, and leather became one of the most widely used materials in the U.S. territories.

In 1809, Samuel Parker, an American inventor, patented the leather splitting machine. This machine allowed workers to make two skins out of one, thereby doubling production. Fleshing and unhairing machines were invented shortly after the splitting machine.

Manufacturers did not begin producing leather for a large market until the 1800's. In the United States, leather became more widely available as the standard of living rose. As more cattle began to be consumed for meat, more hides became available for tanning. Augustus Schultz, an American dye salesman, invented a chrome-tanning process in 1884. The method was perfected about 10 years later by Martin Dennis. Chrome tanning allowed more attractive and flexible leathers to be produced at a much faster rate.

Because of the increasing demand for leather, researchers have developed synthetic leather. Synthetic leather closely resembles natural leather and has many uses. However, it does not have natural leather's ability to *breathe*—that is, to allow perspiration to escape without letting in water from the outside. James E. Churchill

Related articles in *World Book* include:

Buckskin
Chamois
Crocodile
Leathercraft
Shoe

Leathercraft is the art of making useful and decorative objects out of leather. Suede and fur can also be used. The most popular leather-crafted objects include belts, moccasins, hats, purses, saddles, and shoes. Leatherworkers also use leather to create furniture, jewelry, sculptures, and wallhangings.

Leather can be cut, carved, glued, sewn, dyed, and painted. It can also be combined with other materials, such as fabrics and wood, and with other craft techniques, including weaving and macramé. Basic leatherworking consists of four procedures: (1) designing, (2) cutting and assembling, (3) coloring, and (4) finishing.

Designing involves drawing the desired pattern onto the leather. The leatherworker may use chalk or pencil.

Cutting and assembling. Sharp instruments must be used for cutting. These instruments range from knives and household scissors to special leather-cutting shears. The choice of cutting tool depends on the thickness of the material. For example, thick shoe leather requires sharp knives while suede, which is thinner, can be cut with a pair of scissors. Most cuts within the leather are made with special punches. These are sharp steel tools with points in a variety of shapes, such as ovals, diamonds, or stars. The leatherworker places the sharp end of the punch on the leather and drives it into the surface by hitting the blunt end with a rawhide mallet. Designs can be added by *tooling* the surface with chrome-plated carving and stamping instruments. See **Embossing.**

The leatherworker can assemble the leather parts in several ways. For example, he or she can make a series of evenly spaced holes or slits with a leather punch or a pronged chisel. The parts are then assembled by lacing or stitching. Pieces can also be attached by gluing or by nailing one to another with special brads. Leather can be shaped by wetting the material and then folding it or tacking it onto a wooden form. The leather retains the shape of the fold or the form after it dries.

Coloring. Dyes in liquid or powder form are the most reliable for coloring leather. To produce deep



© David R. Frazier

Leathercraft requires special tools. A leatherworker uses a swivel knife to carve designs into the leather, *shown here.*

tones, the leatherworker dampens the leather, thus allowing the dye to penetrate the material. Softer tones can be created by applying dyes to dry leather. Special coloring effects can be achieved by using fabric dyes, acrylic paints, or wood stains. The surface may be polished or buffed after the coloring has dried.

Finishing involves trimming, smoothing, and beveling the edges. Then the surface of the object is polished and buffed. Dona Z. Meilach

Leavenworth, *LEHV uhn wurth* (pop. 35,420), is the oldest city in Kansas. It was founded in 1854. The city lies in the northeastern corner of the state on the Missouri River (see **Kansas** [political map]).

Leavenworth's products include animal health products, automobile batteries, chemical products, fabricated metal, greeting cards, industrial heaters, mill machinery, paper products, and snowplow equipment. St. Mary College and a hospital operated by the United States Department of Veterans Affairs are in Leavenworth. Leavenworth Prison, a federal penitentiary, lies north of the city (see **Leavenworth Prison**). Fort Leavenworth, founded in 1827, stands near the prison. For many years, the fort was the most important Army post on the western frontier. It now serves as headquarters for the U.S. Army's Combined Arms Center, which includes the Command and General Staff College.

Leavenworth is the county seat of Leavenworth County. The city has a commission-manager form of government. J. H. Johnston III

Leavenworth Prison, *LEHV uhn wurth,* is one of the six federal penitentiaries in the United States. Its official name is United States Penitentiary, Leavenworth, Kansas. It is on the Fort Leavenworth reservation on the Missouri River north of Leavenworth. Besides the buildings of the civil prison, a federal military prison also stands on the grounds. Leavenworth Prison was established in 1895. Critically reviewed by the Federal Bureau of Prisons

Leaves. See Leaf.

Leavis, *LEE vihs,* **F. R.** (1895-1978), was one of the most important English literary critics of the 1900's. His ideas about the relation between literature and society strongly influenced the study of English literature.

Leavis emphasized literature's involvement with the society out of which it grew. He argued that literature not only was a product of but also helped to produce the culture of its time. With his wife, Queenie Roth Leavis, he was a founder of *Scrutiny,* a critical journal devoted to preserving the best values of British culture through social analyses of modern and earlier literature. Leavis was the main editor of *Scrutiny* from 1932 to 1953.

In his early books, Leavis favored poets with a "plain" style, such as Geoffrey Chaucer and William Wordsworth. He attacked established "greats," such as Edmund Spenser and John Milton. These views appear in *New Bearings in English Poetry* (1932) and *Revaluation* (1936). In his later writings, Leavis examined the novel to establish a list of authors who combine great seriousness with an involvement in their society. He favored such writers as Jane Austen, Emily Brontë, Joseph Conrad, George Eliot, and D. H. Lawrence. Leavis's later books include *The Great Tradition* (1948) and *D. H. Lawrence: Novelist* (1955).

Frank Raymond Leavis was born in Cambridge. He taught at Cambridge University from 1925 to 1964.
David H. Richter

Leavitt, Henrietta Swan (1868-1921), was an American astronomer. Her work helped later astronomers establish the present scale of the size of the universe.

Leavitt became famous for her study of *Cepheid variables* in the galaxies called the Magellanic Clouds. A Cepheid variable is a type of star whose *luminosity* (brightness) changes regularly with time. The *period* of such a star is the time its light takes to change from bright to dark and back to bright. Leavitt discovered that stars with longer periods had greater average brightnesses than those with shorter periods. This relation, known as the *period-luminosity relation,* is used in many cases to calculate distances to stars and galaxies (see **Astronomy** [Measuring distances in space]).

Leavitt was born in Lancaster, Massachusetts. In 1892, she received a bachelor's degree from the Society for the Collegiate Instruction of Women (now Radcliffe College). She joined the Harvard College Observatory in 1902 and spent her entire career there. C. R. O'Dell

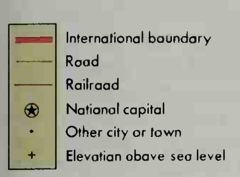
Lebanon, *LEHB uh nuhn,* is a small country at the eastern end of the Mediterranean Sea and the western end of Asia. It has been a center of transportation, trade, and finance for over 100 years. Sandy beaches lie along its coast, and rugged mountains rise in the interior. Beirut, on the coast, is Lebanon's capital and largest city. About half of the country's people live in the Beirut area. Most of Lebanon's people are Arabs. Almost all the people are either Christians or Muslims.

Political differences between Lebanese Christians, and Lebanese Muslims and their Palestine Liberation Organization (PLO) allies erupted into civil war in the mid-1970's. Other rival groups also engaged in fighting. The conflicts caused much death, destruction, and damage to the country's economy. A peace plan ended most of the fighting in 1991.

Government

Lebanon is a republic. The country's National Assembly (parliament) elects a president, who appoints a prime minister. The prime minister and the president

Lebanon







WORLD BOOK maps

head the executive branch of the government. A Council of Ministers (cabinet) carries out the operations of the government. The National Assembly makes the country's laws. Its 128 members are elected by the people to four-year terms.

To maintain a political balance between Christians and Muslims, the government has traditionally been made up of members of both groups on a proportional basis. Seats in the National Assembly have been divided equally between the two groups. Different Christian and Muslim denominations are assigned seats proportionately. A Maronite Christian serves as president, a Sunni Muslim as prime minister, and a Shiah Muslim as speaker of the National Assembly.

Lebanon is divided into six provinces, each of which is headed by a governor. Most of the provinces are divided into districts, which are governed by district heads. Lebanon's main courts are, from highest to lowest, the Court of Cassation, the Courts of Appeal, and the Courts of First Instance.

People

Ethnic groups and religion. About 90 percent of Lebanon's people are Arabs. The Arab population includes about 400,000 Palestinian Arabs, who are refugees from the Arab-Israeli wars. The Palestinians had lived on land that is now part of Israel, Lebanon's neighbor to the south. Other ethnic groups in Lebanon include Armenians, Assyrians, and Kurds. Almost all Lebanese speak Arabic, the country's official language.

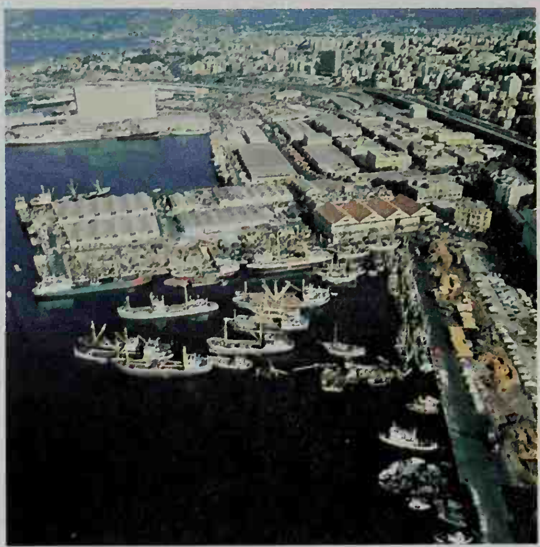
An estimated 60 percent of the Lebanese people are Muslims. Almost all the rest are Christians. Among all the world's Arab countries, Lebanon has the highest percentage of Christians.

Most of Lebanon's Muslims belong to either the Sunni or Shiah division of the Muslim faith. A Lebanese religious group called the *Druse* practices a secret religion related to Islam. The majority of Lebanese Christians are members of the Maronite Church, which is an Eastern Catholic Church.

Way of life. Most wealthy and middle-class Lebanese

Facts in brief

Capital: Beirut.
Official language: Arabic.
Area: 4,015 mi² (10,400 km²). *Greatest distances*—north-south, 120 mi (193 km); east-west, 50 mi (80 km). *Coastline*—130 mi (210 km).
Elevation: *Highest*—Qurnat as Sawda, 10,115 ft (3,083 m) above sea level. *Lowest*—sea level.
Population: *Estimated 2002 population*—3,373,000; density, 840 per mi² (324 per km²); distribution, 88 percent urban, 12 percent rural. *1970 census*—2,126,325.
Chief products: *Agriculture*—apples, cherries, cucumbers, grapes, lemons, oranges, peaches, sugar beets, tomatoes. *Manufacturing*—cement, chemicals, electric appliances, furniture, processed foods, textiles.
Flag: The flag has three horizontal stripes—red, white, and red. A cedar tree on the white stripe symbolizes holiness, eternity, and peace. Adopted in 1943. See **Flag** (picture: Flags of Asia and the Pacific).
Money: *Basic unit*—pound. One hundred piastres equal one pound.



Lebanon Tourist & Information Office

Beirut Harbor is Lebanon's chief port facility. It is located at the eastern end of the Mediterranean Sea.

live in cities, and most are either Christians or Sunni Muslims. The country's poor people—many of whom are Shiah Muslims and Palestinian refugees—live in rural areas or in run-down sections of cities. Large numbers of the Palestinians live in crowded refugee camps.

Traditional Lebanese houses have thick limestone walls and roofs made of orange tiles or earth. This type of house is being rapidly replaced in the cities by modern Western-style concrete houses and high-rise apartment buildings.

Most Lebanese wear the same styles of clothing as do people in Western nations. But some rural people still wear traditional Lebanese clothes. Some peasant women, for example, wear colorful long dresses with ankle-length trousers underneath. Some elderly Druse religious men wear woven multicolored jackets and white headdresses.

Bread, fruits, grains, meat, vegetables, and yogurt are the chief foods of most Lebanese. The people combine these foods with herbs and spices to create a variety of tasty dishes. Popular beverages in Lebanon include soft drinks, Arabic coffee, wine, beer, and a strong liquor called *arak,* also spelled *arrack.*

Many Lebanese enjoy the literature, music, and art of both Arabic and Western cultures. Lebanese artists are noted for the beautiful silverware, brassware, jewelry, needlework, and colorful glassware they produce. Popular sports in Lebanon include basketball, soccer, skiing, table tennis, and volleyball. Beaches near the coastal cities are favorite recreation areas.

Education. Lebanese law does not require children to attend school. But most parents send their children to both elementary and secondary school. More than half the schoolchildren go to private schools, which charge tuition, and the rest attend free public schools.

Universities and colleges in Lebanon include the Lebanese University, the Beirut Arab University, Beirut University College, Haigazian College, the American University of Beirut, and St. Joseph University. The American University of Beirut is a private school controlled by a board of trustees in the United States. St. Joseph University is a Roman Catholic school of the Jesuit order.

Land and climate

Lebanon covers 4,015 square miles (10,400 square kilometers). Its coast extends about 130 miles (209 kilometers) along the Mediterranean Sea. A narrow plain runs along the coast. Farmers raise a variety of fruits on the plain, and most of Lebanon's main cities are there.

The rugged Lebanon Mountains rise east of the coastal plain. They extend, from north to south, down most of the length of the country—a distance of about 100 miles (160 kilometers). The country's highest peak, Qurnat as Sawda, is in the Lebanon Mountains. It rises 10,115 feet (3,083 meters) above sea level. Farmers raise fruit on irrigated terraces built on the slopes of the mountains. The upper slopes of the Lebanon Mountains once were covered with the majestic cedars of Lebanon. Most of the trees were cut down in past centuries, but a grove of ancient and beautiful trees survives in the northern mountains. Another range, the Anti-Lebanon Mountains, runs along the country's eastern border.

A fertile valley called the *Bekaa* lies between the Lebanon and Anti-Lebanon mountains. The Bekaa ranges from 5 to 10 miles (8 to 16 kilometers) in width. It is the site of the ruins of several ancient cities. Much of the Bekaa is used for vegetable farming.

Lebanon's main rivers are the Litani, Nahr Ibrahim, and Orontes. Temperatures in the country's coastal area average about 55 °F (13 °C) in January and about 84 °F (29 °C) in June. Most of the area is very humid in the summer. Inland areas have generally lower average temperatures and less humidity than the coast. About 35 inches (89 centimeters) of rain falls annually along the coast. The mountains receive from 50 to 60 inches (130 to 150 centimeters) of rain yearly and much snow in the winter. The Bekaa receives less rain than the mountains.

Economy

The civil war of the mid-1970's and numerous battles that followed seriously damaged Lebanon's economy. The fighting closed many businesses and left many people unemployed. Many businesses and industries continued to function, however, especially the banking system. In addition, much housing construction has taken place in and around Beirut.

Service industries, including trade and finance, rank as Lebanon's chief sources of income. Since the 1820's, Lebanon has been a major import and export center of the Middle East. It has also been an important financial center, with about 100 banks—including branches of foreign banks—in operation. Since the war, trade and finance have decreased in Lebanon, but they remain important to the economy. The country once drew large numbers of tourists, whose spending contributed greatly to the economy. However, the fighting all but ended tourism.

Manufacturing and agriculture are also important economic activities in Lebanon. The chief manufactured products include cement, chemicals, electric appliances, furniture, processed foods, and textiles. Fruits—including apples, cherries, grapes, lemons, oranges, and peaches—rank as Lebanon's chief farm products. Potatoes, sugar beets, and other vegetables are also important.

Beirut is Lebanon's chief port. The country's roads are good, but railway services are limited. About 40 daily newspapers are published in the country.

History

Ancient times. Lebanon has been inhabited since prehistoric times. Phoenicians were the first well-known group of people to live there. They may have moved to the region from the south about 2000 B.C. The Phoenicians were sailors, traders, and explorers. They established powerful independent city-states along the coast.

Beginning about 1800 B.C., other foreign powers controlled the Phoenician city-states at different times. They included, in order of rule, Egyptians, Hittites, Assyrians, Babylonians, and Persians. In 332 B.C., the famous Macedonian general Alexander the Great conquered Lebanon. The region came under the control of the Roman Empire in 64 B.C. Ruins of Roman structures still stand. They include huge temples at Baalbek, in the Bekaa; and the town at Bayt Miri, near Beirut. Christianity was introduced into Lebanon about A.D. 325. Many Lebanese became Christians. In 395, the region became part of the Byzantine Empire, a continuation of the Roman Empire.

Muslim rule. In the early A.D. 600's, Muslims from the Arabian Peninsula occupied Lebanon. Islam gradually replaced Christianity along Lebanon's coast. However, Christianity remained strong in the mountains.

Crusaders from Europe invaded Lebanon about 1100. The crusaders were Christians who hoped to regain the nearby Holy Land (Palestine) from the Muslims (see **Crusades**). Christians in the mountains of Lebanon developed friendly relations with the crusaders. In about 1300, the Mameluke dynasty of Egypt drove the last of the crusaders out of Lebanon.

Ottoman rule and independence. The Ottomans conquered Lebanon in 1516 and made the region part of the Ottoman Empire, which had its capital at Istanbul, in what is now Turkey. But Mount Lebanon, located in the central part of the country, retained limited self-government under local rulers. The Ottoman Empire ruled Lebanon until World War I (1914-1918), when Britain and France occupied the country.

In 1922, France took over Lebanon's political affairs and started to prepare Lebanon for independence. The French united the Christians in Mount Lebanon and the Muslims along the coast under one government. They also helped write Lebanon's Constitution. Lebanon became completely independent in 1943. Christian and Muslim leaders agreed to share power in the government. Following independence, Lebanon prospered more than ever as a center of trade and finance.

Internal conflicts. Lebanon retained strong ties with the West after it became independent. The country remained peaceful until 1958, when some Lebanese, largely Muslims, rebelled against the government. The rebels opposed government plans for political and military alliances with the West. In July 1958, the United States sent thousands of marines to Lebanon at the request of the country's president. This U.S. intervention helped restore peace, and the marines left in October.

In 1969, the activities of the Palestine Liberation Organization (PLO) led to fighting in Lebanon. The PLO—whose chief goal is to establish a Palestinian state for the Arab people of Palestine—raided targets in Israel from bases in southern Lebanon. The Israelis, in turn, attacked PLO forces in Lebanon.

In the 1970's, conflict between Lebanese Christian and Muslim groups flared up. The Christians opposed, and the Muslims supported, the presence of armed PLO members in the country. Also, the country's Muslim population had grown, and the Muslims demanded more power in the government. The PLO supported the Muslims. The Christians opposed Muslim demands for increased power in the government and resented the alliance between the Muslims and the PLO.

War and terrorism. In 1975, a civil war broke out between Christians and the Muslim-PLO alliance. The fighting killed tens of thousands of people and caused widespread property damage. In the spring of 1976, Syria—which borders Lebanon on the north and east—sent thousands of troops to the country in an effort to restore order.

Full-scale fighting in Lebanon ended in late 1976. However, periodic fighting took place between Christians and the Muslim-PLO alliance. Also, both Christian groups and Muslim groups began fighting among themselves. Battles also broke out between Christians and Syrian troops in Lebanon. In 1989, large-scale fighting broke out between Christians and Syrians in Beirut. It resulted in extensive damage to the city.

Conflicts between Israel and the PLO also continued. Because of the continual conflict, the United Nations (UN) sent a peacekeeping force to Lebanon in 1978. But fighting continued to break out.

In June 1982, a large Israeli force invaded Lebanon and drove the PLO forces out of the southern part of the country. The Israelis laid siege to western Beirut, an area where many PLO leaders and troops were stationed. The Israelis demanded that the PLO leave the city and the rest of Lebanon. The invasion resulted in many deaths—both military and civilian—and much damage. In late August and early September, the PLO forces left Beirut. Some PLO troops remained in northern Lebanon.

In mid-September, Bashir Gemayel, president-elect of Lebanon and leader of the Lebanese Christian militia, was assassinated. Two days later, members of the Lebanese Christian militia killed hundreds of unarmed Palestinian civilians in refugee camps in the Israeli-occupied part of western Beirut. Israeli forces were aware of what was going on, but chose not to intervene.

The United States, France, and Italy had sent troops to Lebanon to help ensure that the PLO forces could leave the country safely. The troops left Lebanon after the PLO withdrawal. But about two weeks later—following the massacre—the Lebanese government requested that the foreign troops return to help keep order. The United States, France, Italy, and Britain then sent troops to Lebanon. Also, the UN peacekeeping force and the Israeli and Syrian troops, who had entered the country earlier, remained in Lebanon.

In late 1983, foreign troops in Lebanon became victims of terrorist bombings. On October 23, a suicide terrorist crashed a truck loaded with explosives into U.S.



A. Dejean, Sygma

Lebanon's civil war caused great damage in many cities. The scene above shows a damaged area in Beirut.

Marine headquarters at the Beirut airport. The resulting explosion killed 241 U.S. marines. At about the same time, a similar attack killed 58 French soldiers in a nearby building. On November 4, an attack at the Israeli military headquarters in Tyre killed 28 Israelis.

In early February 1984, Druse forces and Shiite Muslims—members of the Shiah branch of Islam—took control of part of Beirut from the Lebanese government. The United States, Britain, France, and Italy removed their troops from Lebanon following this take-over. In 1985, Israel withdrew its troops from all of Lebanon except a security zone along the country's Israeli border.

Terrorism continued in Lebanon. In 1987, unknown terrorists placed a bomb aboard a military helicopter in which Lebanon's prime minister, Rashid Karami, was traveling. Karami was killed in the explosion. Various groups in Lebanon took foreigners—mostly Americans and Western Europeans—as hostages.

Recent developments. In September 1988, the National Assembly failed to elect a successor to then-president Amin Gemayel. Before he left office, Gemayel, a Christian, appointed another Christian, General Michel Aoun, to replace the Muslim prime minister, Salim al-Huss, and serve until the Assembly chose a new president. Gemayel also appointed a new cabinet. Muslims in Lebanon refused to recognize the interim government because it violated the power-sharing agreement of 1943 that stated that the prime minister be a Muslim. Al-Huss claimed he and his cabinet had the right to remain in office. Thus, Lebanon had two governments.

On Nov. 5, 1989, the Assembly elected a new Christian president, René Mouawad. Mouawad was assassinated on November 22. The Assembly elected Elias Hrawi, also a Christian, president. It also approved an agreement giving more power to the country's Muslim majority. But Aoun refused to recognize the agreement or Hrawi's government. In October 1990, Syrian commandos backed by Hrawi defeated Aoun's forces.

Although the PLO military forces had been driven out of southern Lebanon in 1982, some PLO forces later reestablished military bases there. In 1991, the PLO and other Palestinians refused to obey an order by the Lebanese government to leave the bases. But the Lebanese Army defeated the Palestinians and disarmed them. Most of the fighting in Lebanon then ended. However, Syrian forces still held parts of the country, and the Israelis continued to occupy part of southern Lebanon as a security zone. Many opponents of this occupation joined a movement known as Hezbollah (also spelled Hizbollah), and guerrillas from the group often clashed with the Israelis and the Israeli-backed South Lebanon Army. In 1991 and 1992, all known living American and Western European hostages were released. Some of the hostages had been killed or had died of natural causes.

In 1998, Lebanon held its first presidential election since the end of its civil war. Emile Lahoud, the Army's commander, won the election. In May 2000, Israel withdrew its troops from southern Lebanon. Hezbollah guerrillas immediately took control of the area. By September, UN peacekeepers and Lebanese security forces had moved into most of southern Lebanon. Hezbollah controlled the area closest to the Israel-Lebanon border. Violence has continued between Hezbollah and Israeli forces near the border. Elsa Marston Harik and Iliya Harik

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Additional resources

Collelo, Thomas, ed. *Lebanon.* 3rd ed. U.S. Government Printing Office, 1989.
Marston, Elsa. *Lebanon.* Dillon Pr., 1994. Younger readers.

LeBlanc, *luh BLAHN,* **Roméo,** *roh MAY oh* (1927-), served as governor general of Canada from 1995 to 1999. He was the first person from Canada's Atlantic Provinces and the first Acadian to hold the post. Acadians are descendants of early French settlers in the Acadia region of southeastern Canada. A Liberal, LeBlanc had served in the Canadian Senate since 1984 and had been speaker of the Senate since 1993. Liberal Prime Minister Jean Chrétien chose him for governor general.

Roméo Adrian LeBlanc was born in L'Anse-aux-Cormier, New Brunswick. He received bachelor's degrees from St. Joseph University in New Brunswick in 1948 and 1951. After working as a teacher, he became a foreign correspondent for the French-language service of the Canadian Broadcasting Corporation. From 1967 to 1971, he was press secretary to Liberal prime ministers Lester B. Pearson and Pierre Elliott Trudeau. From 1972 to 1984, LeBlanc represented New Brunswick's *riding* (district) of Westmorland-Kent in Canada's House of Commons. While in the Commons, he served in Trudeau's Cabinet, chiefly as fisheries minister. E. Kaye Fulton

Le Carré, *leh kuh RAY,* **John** (1931-), is the pen name of David John Moore Cornwell, an English novelist. He is known for his realistic and unromantic spy stories. Most of his spies are low-level British civil servants who are involved with the routine affairs and rivalries of a government bureaucracy as well as with the confusions of cloak-and-dagger intrigue. In his later novels, Le Carré shifted from the intrigues of the Cold War to the greed of multinational dealers in arms and drugs.

In *The Spy Who Came in from the Cold* (1963) and *The Looking Glass War* (1965), Le Carré created central characters who are manipulated by their superiors and partly fail. He wrote three novels about British secret service agent George Smiley—*Tinker, Tailor, Soldier, Spy* (1974), *The Honourable Schoolboy* (1977), and *Smiley's People* (1979). Smiley is the main character in the suspense novels *Call for the Dead* (1961) and *A Murder of Quality* (1962), and is in *The Secret Pilgrim* (1990). Le Carré's other novels include *A Small Town in Germany* (1963), *The Little Drummer Girl* (1983), *A Perfect Spy* (1986), *The Russia House* (1989), *The Night Manager* (1993), *The Tailor of Panama* (1996), *Single & Single* (1999), and *The Constant Gardener* (2000). Le Carré was born in Poole. He served as a British intelligence officer in Austria after World War II. From 1961 to 1964, he was an officer in the British Foreign Service. Michael Seidel

Le Corbusier, *luh kawr byoo ZYAY* (1887-1965), was the professional name of Charles Édouard Jeanneret-Gris, often considered the most important architect of the 1900's. He showed his mastery of design in a series of houses during the 1920's. They included the villa "Les Terraces" (1926-1927) in Garches and the Villa Savoye (1929-1931) in Poissy, both near Paris. Both are examples of what came to be known as the *International Style.*

The International Style was identified by white cubic shapes and the avoidance of ornament. Such characteristics, however, are not central to Le Corbusier's work. In his "Five Points" (1927), a series of diagrams, he made an apparently simple but imaginative connection between theory and practice. In 1914 and 1915, he invented the *dom-ino* system, in which he used certain characteristics of reinforced concrete construction to enclose and use space in new ways.

Le Corbusier's five points called for the use of (1) *pilotis* (columns that raise a building above the ground); (2) flat roofs with gardens; (3) the *free plan* (independence of the structural frame from the internal walls); (4) the *free façade* (no structural limitation on window placement); and (5) a continuous horizontal window (one aspect of the free façade).

Le Corbusier's new approach to a structure's form and use was part of what he called the New Spirit that liberates humanity for its full development. This spirit—especially as it appeared in the arts—was discussed in a magazine called *l'Esprit Nouveau* (1920-1925), edited by Le Corbusier and the French painter Amedée Ozenfant. Le Corbusier's essays on architecture were collected in his major book, *Vers une Architecture* (*Towards a New Architecture,* 1923).

During the 1930's and 1940's, Le Corbusier built few buildings. His interest in city planning became dominant. He proposed the demolition of urban areas and their rebuilding according to his ideas on planning and architecture. His major achievement in city planning was his plan and design for the principal buildings of the new city of Chandigarh, India, in the 1950's.

In his final buildings, Le Corbusier continued to demonstrate his understanding for architectural form interacting with functional and social conditions. These works include the Unité d'Habitation apartment building in Marseille, France (1947-1952); the pilgrimage chapel in Ronchamp, France (1951-1955); and the Carpenter Center for the Visual Arts at Harvard University in Cambridge, Mass. (1960-1963).

Le Corbusier was born in La Chaux-de-Fonds, Switzerland. He settled in Paris in 1917. He received formal training under the architects Auguste Perret in Paris and Peter Behrens in Berlin. Dennis Domer

See also **Architecture** (Modern architecture; picture: The International Style).

Lederberg, Joshua (1925-), an American geneticist, shared the 1958 Nobel Prize for physiology or medicine. He received the award "for his discoveries concerning genetic recombination and the organization of the genetic material of bacteria." Lederberg was born in Montclair, N.J. Alan R. Rushton

Lee, Charles (1731-1782), was an officer in the American army during the Revolutionary War (1775-1783). Although he fought bravely, he was not always obedient, and some historians regard him as a traitor.

Lee was born in Chester, England, and joined the British Army. He served in the Seven Years' War (1756-1763), and took part in the capture of Montreal in 1760. After returning to North America in 1773, Lee joined the patriots against the British. He became a major general in 1775. In 1776, he led the American army in the South.

The British captured Lee in 1776 at Basking Ridge, N.J., and held him in New York for a year. They released him in 1778, and Lee returned to fight with the patriot forces. At the Battle of Monmouth in 1778, he advanced with the American forces against the British Army, then retreated. Lee asked for a court-martial, and he was found guilty of misconduct. John W. Ifkovic

Lee, Doris Emrick (1905-1983), was an American artist. Her paintings portray the American scene in a lively, sometimes humorous, and always colorful manner. Her painting *Thanksgiving* won the Logan Medal at the 1935 annual exhibition of contemporary American painting at the Art Institute of Chicago. She painted a mural for the Post Office Department building in Washington, D.C.

Doris Lee was born in Aledo, Ill. She studied at the Kansas City Art Institute, at the California School of Fine Arts, and in Paris. Sarah Burns

See also **Thanksgiving Day** (picture).

Lee, Francis Lightfoot (1734-1797), was a Virginia signer of the Declaration of Independence. As a member of the Virginia House of Burgesses from 1758 to 1776, he helped lead the protest against the Stamp Act and other British measures that were unpopular with the American Colonies. He helped form the Virginia Committee of Correspondence in 1773 (see **Committees of correspondence**). In 1775, Lee was elected as a delegate to the Continental Congress, where he ably served the colonial cause. He resigned in 1779 to return to his plantation.

Lee was a brother of the revolutionary leader Richard Henry Lee and an ancestor of Confederate General Robert E. Lee. He was born in Westmoreland County, Virginia. Robert A. Becker

Lee, Harper (1926-), is an American author who became famous with her only novel, *To Kill a Mockingbird* (1960). It won the 1961 Pulitzer Prize for fiction.

The plot centers on Atticus Finch, a small-town lawyer in Alabama who defends a young black falsely accused of raping a white woman. The story is told by the lawyer's young daughter. The appeal of the novel lies in the author's ability to weave together the vivid eccentric characters of a small town, the observations of a sensitive child, and a plea for social justice.

Nelle Harper Lee was born in Monroeville, Ala. She grew up in the state and attended the University of Alabama. Noel Polk

Lee, Henry (1756-1818), was a noted American cavalry leader during the Revolutionary War in America (1775-1783). His success as a scout and in making lightning raids won him the nickname of "Light-Horse Harry." After the war, Lee became a leading statesman. He was a member of the powerful Lee family of Virginia and the father of Confederate General Robert E. Lee.

Lee became a captain in the Virginia cavalry in 1776, and the next year his company joined George Washington's army. In 1778, Lee was made a major in charge of a force of cavalry and infantry that became known as "Lee's Legion." In 1779, he led the group in a daring raid on the British post at Paulus Hook, N.Y. (now Jersey City, N.J.). In 1780, Lee became a lieutenant colonel and was assigned to fight under General Nathanael Greene in the South.

After the war, Lee entered the Virginia House of Delegates. He served in the Congress of the Confederation from 1785 until 1788. He was also a member of the Virginia convention that ratified the Constitution of the



Detail of an oil painting on canvas (1782) by Charles Willson Peale; Independence National Historical Park Collection

"Light-Horse Harry" Lee was a brave and daring cavalry leader in the American army during the Revolutionary War.

United States. Lee served as governor of Virginia from 1791 to 1794, and commanded the troops that President Washington sent in 1794 to end the Whiskey Rebellion (see **Whiskey Rebellion**). Lee was a member of the Federalist Party. From 1799 to 1801, he served as a member of Congress. He wrote the famous epitaph of George Washington, "First in war, first in peace, and first in the hearts of his countrymen."

Lee fell deeply into debt in later years, and was imprisoned in 1808 and 1809. During this time, he wrote his *Memoirs of the War in the Southern Department of the United States.* In 1812, he was injured while trying to protect a friend from rioters in Baltimore. He never fully recovered from this injury.

Lee was born on Jan. 29, 1756, at "Leesylvania," Prince William County, Virginia. He graduated from the College of New Jersey (now Princeton University) in 1773.

William Morgan Fowler, Jr.

Lee, Jason (1803-1845), a Canadian-born Methodist missionary, is remembered as the first missionary to bring Christianity to the Indians of the Pacific Northwest. He was also a leader of the first permanent American settlement in the Oregon region. Lee was born in Stanstead, Que., and attended Wesleyan Academy in Wilbraham, Mass. In 1834, he traveled overland to Fort Vancouver (now Vancouver, Wash.) with the explorer Nathaniel J. Wyeth and founded several missions. In 1840, Lee enlarged the missions with 51 New Englanders, who helped him set up several schools. A statue of Lee represents Oregon in Statuary Hall.

Robert C. Carriker

Lee, Manfred B. See **Queen, Ellery**.

Lee, Richard Henry (1732-1794), was a Virginia signer of the Declaration of Independence. In 1758, he was elected to the Virginia legislature, where he served until the outbreak of the Revolutionary War in America in 1775. During this time, he became especially active in Virginia's campaign of resistance to Great Britain's Stamp Act and Townshend Acts, both of which raised the taxes of American colonists.

In 1774, Virginia sent Lee as a delegate to the First Continental Congress in Philadelphia. At first, he favored a policy of economic pressure on the British government. But, by late 1775, he began to support American independence. On June 7, 1776, Lee introduced a resolution that "these United Colonies are, and of right ought to be, free and independent States . . . and that all political connection between them and the State of Great Britain is, and ought to be, totally dissolved." The adoption of this resolution by the Congress on July 2 was the signal for American independence.

Lee was elected president of the Congress in 1784. He was chosen to attend the Constitutional Convention in 1787 but did not go. He then helped lead the opposition to the United States Constitution but served as a U.S. senator from Virginia after it was adopted. As a senator, Lee helped lead the successful effort to add the 10 amendments called the Bill of Rights to the Constitution in 1791. Lee was born in Stratford Hall, near Montross, Va., and was educated in England. Robert A. Becker

Lee, Robert Edward (1807-1870), was a great general who commanded the Confederate Army in the Civil War. He is one of the most beloved figures in American history. Lee's fame rests on his military achievements as Confederate commander in the face of overwhelming odds, and on his outstanding personal character. He won the admiration and respect of Northerners as well as Southerners. Lee fought for one section of the young nation, but the struggle did not make him intolerant. He fought, not for personal gain, but to prove himself worthy of a cause. Union General Ulysses S. Grant, to whom Lee was finally forced to surrender, said about Lee: "There was not a man in the Confederacy whose influence with the whole people was as great as his."

Unlike President Abraham Lincoln, who led the North in the Civil War, Lee was not a self-made man. Lee's family was the leading family of Virginia, and one of the most distinguished in the United States. A kinsman, Thomas Lee, had served as royal governor of the colony. Lee was also related to Francis Lightfoot Lee and Richard Henry Lee, who had been statesmen and soldiers in Revolutionary War days. His father, Henry Lee, known as "Light-Horse Harry," was a brilliant cavalry commander in the Revolutionary War. When the Lee mansion, Matholic, burned in the early 1700's, Queen Caroline of England gave Thomas Lee money to help rebuild it. Lee called the new building Stratford Hall.

Robert E. Lee was a handsome man, 5 feet $10\frac{1}{2}$ inches (179 centimeters) tall and weighing about 170 pounds (77 kilograms). He had a commanding appearance—straight, alert, and intelligent. He was never known to smoke, drink alcoholic beverages, or use profane language.

Early years

Robert E. Lee was born in Stratford Hall, near Montross, Va., on Jan. 19, 1807. He grew up with a deep devotion to country life and to his native state, which continued throughout his life. He was a serious boy, and spent many hours in his father's library. In 1825 he entered the United States Military Academy at West Point, where his classmates admired him for his brilliance, leadership, and devotion to duty. He graduated from the academy with high honors in 1829, and he was commissioned as a second lieutenant in the Corps of Engineers.

In the Corps of Engineers. Lee served for 17 months at Fort Pulaski on Cockspur Island, Georgia. In 1831, the

army transferred him to Fort Monroe, Virginia, as assistant engineer. While stationed there, he married Mary Anna Randolph Custis (1808-1873), Martha Washington's great-granddaughter. They lived in her family home, Arlington, which still stands on a Virginia hill overlooking Washington, D.C. Their seven children—George Washington Custis, Mary, William H. Fitzhugh, Agnes, Annie, Robert Edward, and Mildred—were reared chiefly at Arlington. All three sons served as Confederate officers under Lee during the Civil War.

Lee served as an assistant in the chief engineer's office in Washington from 1834 to 1837, but spent the summer of 1835 helping to lay out the boundary line between Ohio and Michigan. His first important independent job came in 1837 when, as a first lieutenant of engineers, he supervised the engineering work for St. Louis harbor and for the upper Mississippi and Missouri rivers. His work there earned him a promotion to captain. In 1841 he was transferred to Fort Hamilton in New York harbor, where he took charge of building fortifications.

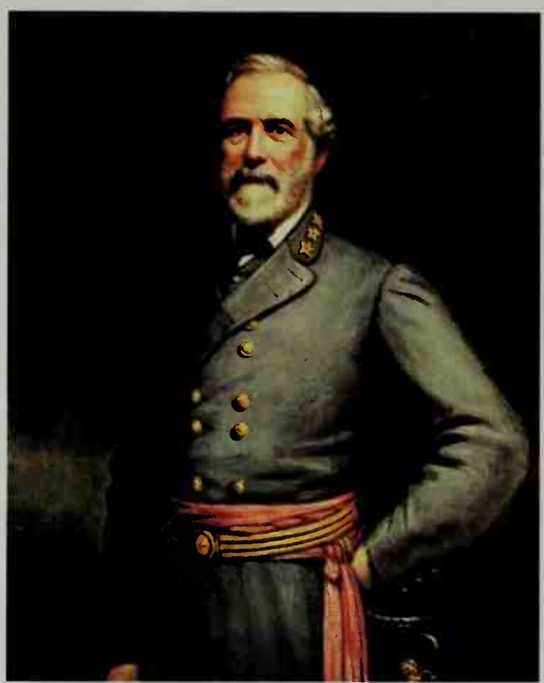
The Mexican War. When war broke out between the United States and Mexico in 1846, the army sent Lee to Texas to serve as assistant engineer under General John E. Wool. All his superior officers, especially General Winfield Scott, were impressed with the brave young Virginian.

Early in the war, Lee supervised the construction of bridges for Wool's march toward the Mexican border. He then did excellent work on scouting trips. He was shortly transferred to General Winfield Scott's command and took part in the capture of Veracruz. Lee's engineering skill made it possible for American troops to cross the difficult mountain passes on the way to the capital. During the march to Mexico City, Lee was promoted to brevet major, then to brevet lieutenant colonel. He was promoted to brevet colonel before the war ended.

The official reports praised Lee highly. Scott declared that his "success in Mexico was largely due to the skill, valor, and undaunted courage of Robert E. Lee . . . the greatest military genius in America."

Superintendent of West Point. After three years at Fort Carroll in Baltimore harbor, Lee became superintendent of West Point in 1852. He would have preferred duty in the field, instead of at a desk, but assumed his post without complaint. During his three years at West Point, he improved the buildings and the courses, and spent much time with the cadets. One cadet, Jeb Stuart, later served as one of Lee's best cavalry officers. Lee won a reputation during his service there as a fair and kind superintendent.

Other duties. In 1855, Lee became a lieutenant colonel of cavalry and was assigned to duty on the Texas frontier. There he helped protect settlers from attacks by the Apache and Comanche Indians. Once again he proved to be an excellent soldier and organizer. But these were not happy years for Lee. He did not like to be away from his family for long periods of time, particularly because of Mrs. Lee, who was becoming an invalid. Lee came home to see her as often as possible. He happened to be in Washington at the time of John Brown's raid on Harpers Ferry in 1859, and was sent there to arrest Brown and restore order. He accomplished this task quickly and with little loss of life, then returned to his regiment in Texas. When Texas seceded from the Union in 1861, Lee was recalled to Washington, D.C., to wait for further orders.

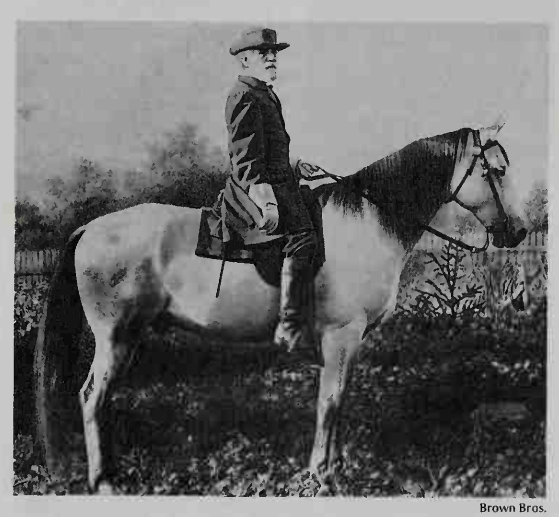


Oil painting on canvas (1904) by Theodore Pine; Lee Chapel, Washington and Lee University, Lexington, Va.

General Robert E. Lee commanded the Confederate Army in the Civil War. He ranks among the nation's greatest heroes.

The Civil War

Unlike many Southerners, Lee did not believe in slavery and did not favor secession. He felt that slavery had an evil effect on masters as well as slaves. Long before the war, he had freed the few slaves whom he had in-



Brown Bros.

Lee posed astride his famous horse, Traveller, which he rode throughout the Civil War. The famous Southern general was known for his dignity and calm, even in times of stress.

herited. Lee greatly admired George Washington, and hated the thought of a divided nation. But he came to feel that his state was protecting the very liberty, freedom, and legal principles for which Washington had fought. Lee was willing to leave the Union, as Washington had left the British Empire, in order to fight what the South regarded as a second war of independence.

Lee had great difficulty in deciding whether to stand by his native state or remain with the Union, even though Lincoln offered him the field command of the United States Army. He wrote his sister: ". . . in my own person I had to meet the question whether I should take part against my native state. With all my devotion to the Union, and the feeling of loyalty and duty of an American citizen, I have not been able to make up my mind to raise my hand against my relatives, my children, my home. I have therefore resigned my commission in the army, and, save in defense of my native state—with the sincere hope that my poor services may never be needed—I hope I may never be called upon to draw my sword."

Lee grieved at parting from the companions with whom he had served in other wars. He had always felt that the "cordiality and friendship in the army was the great attraction of the service." The break with General Scott, his commander in chief, was especially difficult because the two men were close friends.

Opening campaigns. For a time after Lee joined the Confederate Army, he had no troops under his command. He served in Richmond, Va., as military adviser to Confederate President Jefferson Davis, and in May 1861, was appointed a full general. In the fall, he succeeded in halting a threatened invasion from western Virginia. Later, he took charge of fortifying the coast of South Carolina against invasion.

When Lee returned to Richmond in 1862, he helped draw up plans for the Confederate forces in Virginia, then under the command of General Joseph E. Johnston. Johnston was wounded on May 31, 1862, in the Battle of Fair Oaks (Seven Pines). The next day, Lee took command of Johnston's army, which he called the Army of Northern Virginia.

From his first day of command, Lee faced what looked like an impossible task. Union General George B. McClellan had approached within 7 miles (11 kilometers) of Richmond with 100,000 men. Three forces were closing in on the Confederate troops of General Stonewall Jackson in the Shenandoah Valley of Virginia. A fourth Union force was camped on the Rappahannock River, ready to aid McClellan. In a series of engagements known as the Battles of the Seven Days, Lee forced McClellan to retreat. This campaign taught Lee the need for simpler methods and organization. Jackson had earlier conducted a brilliant campaign in the Shenandoah Valley and became Lee's most trusted subordinate. Jackson was so devoted to Lee that he said he would follow him into battle blindfolded.

With Jackson's help, Lee won a major victory over General John Pope in the second Battle of Bull Run (Manassas), in August 1862. He was then free to invade Maryland. Unfortunately, McClellan intercepted a battle order which a Confederate staff officer had carelessly lost. Knowing Lee's plans in advance, McClellan halted him in the Battle of Antietam (Sharpsburg). Lee returned to Virginia to reorganize the Confederate army.

Later battles. General Ambrose E. Burnside led an attack against Lee in December 1862, at Fredericksburg, Va. It was on this occasion that Lee made a statement that has since become famous. Fog covered the battlefield early in the morning before the battle began. As it lifted and the Confederate command surveyed the panorama of thousands of troops in full array, Lee remarked: "It is well that war is so terrible—we would grow too fond of it."

Lee's troops badly defeated the Union forces. But Lee could not take advantage of his victory. The Northern troops had been too cleverly placed, and could fall back without breaking their lines of communication. The Confederates had few reserves of men and supplies. Lee felt that his army could not win the war by fighting defensively, and that it was too costly simply to hold the enemy without destroying it. But first he had to fight another defensive battle.

General Joseph Hooker, who had taken over from Burnside, attacked Lee at Chancellorsville in the spring of 1863. The Confederate forces won a spectacular victory, but they also paid a terrible price for it—the death of Stonewall Jackson, who was accidentally shot by his own men when he went ahead of his line of battle to scout.

Determined to take the offensive, Lee moved into Pennsylvania and encountered the Northern army now under General George G. Meade, at Gettysburg. Bitter fighting continued for three days, from July 1 to 3, 1863. The Confederates met defeat in what proved to be a turning point of the war. Always generous to those under him, Lee insisted on taking the blame for the failure of the campaign.

Final engagements. In the spring of 1864, Lee first faced General Ulysses S. Grant. In a series of fierce and bloody battles called the Wilderness campaign, Grant pounded the Army of Northern Virginia to pieces with his larger forces and guns. During one of these battles, Lee's men vividly demonstrated the affectionate regard they all felt for "Marse Robert." As a division of Texans marched past Lee on their way to the front, he left his post to join them. But the soldiers insisted that he return to the rear, saying "We won't go unless you go back!"

Lee held out for nine months in the siege of Petersburg, but his tired, hungry men finally had to retreat. Early in 1865, Lee was made general in chief of all the Confederate armies. Richmond fell in April 1865, and Lee's ragged army retreated westward. Northern forces cut off and surrounded Lee's troops at Appomattox Court House, Va., where Lee surrendered to Grant on April 9, 1865. Grant tried to make the surrender as easy as possible, and allowed the Confederate troops to take their horses home for spring plowing. As Lee made his last ride down the lines on his famous horse, Traveller, he told his army: "Men, we have fought through the war together. I have done my best for you; my heart is too full to say more."

Last years

Lee now became a private citizen for the first time in 40 years. The Proclamation of Amnesty and Reconstruction of 1865 barred him from taking public office. But he applied for a complete individual pardon as provided by





D. Forbert, Shostal

Lee's birthplace, Stratford Hall, *above,* in Westmoreland County, Virginia, is now a museum. His later home, Arlington, *below,* was begun in 1802 by a step-grandson of George Washington. Made into a memorial to Lee in 1955, it is now called Arlington House. It overlooks the Potomac in Arlington National Cemetery.



Shostal



the proclamation, hoping to set an example for other Southern leaders to follow. But the application lacked a required oath of allegiance to the United States. Lee then signed an oath and sent it to Washington. But the oath became lost, and Lee was not pardoned. A general amnesty of 1868 restored his right to vote. But Lee still lacked the right to hold public office. In 1970, an employee of the National Archives found Lee's oath. In 1975, Congress restored Lee's full citizenship.

Lee could have had many positions of wealth and prestige, but he chose to spend his last years as president of Washington College in Lexington, Virginia. He soon raised the small college to high levels of scholarship and established schools of commerce and journalism. Young men from all parts of the South flocked to "General Lee's school," which was named Washington and Lee University after his death.

Lee urged his students and his friends to keep the peace and accept the outcome of the Civil War. His attitude was very important at a time when bitterness and hatred swept both North and South. Instead of increasing this feeling, Lee opposed it, doing everything in his power to restore the political, economic, and social life of the South. "Make your sons Americans," he urged.

His health began to fail in 1870, and, after a brief illness, he died on Oct. 12, 1870. People throughout the country felt his death as a personal loss. Viscount Garnet Wolseley, a distinguished British soldier, spoke eloquently of Lee: "I have met many of the great men of my time, but Lee alone impressed me with the feeling that I was in the presence of a man who was cast in a grander mold and made of different and finer metal than all other men. He is stamped upon my memory as a being apart and superior to all others in every way—a man with whom none I ever knew, and very few of whom I have read, were worthy to be classed."

Lee is buried in the chapel he built on the campus in Lexington, along with other members of the Lee family. This chapel is sometimes called "The Shrine of the South" and is visited by thousands every year. Lee's home has been preserved in Arlington National Cemetery, near Washington, D.C. January 19, Lee's birthday anniversary, is a legal holiday in most Southern states. Lee represents Virginia in Statuary Hall in the Capitol in Washington. Thomas L. Connelly

See also **Civil War; Lee, Henry.**

Additional resources

Kerby, Mona. *Robert E. Lee.* Enslow, 1997. Younger readers.
Taylor, John M. *Duty Faithfully Performed: Robert E. Lee and His Critics.* Brassey's, 1999.
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Lee, Spike (1957-), is an American motion-picture director. He emerged in the 1980's as the most prominent figure in a new generation of black filmmakers. Many of Lee's films explore controversial issues within the urban black community and also deal with relations among ethnic groups. Lee also writes his own screenplays. *School Daze* (1988) is a musical about conflicts between light-skinned and dark-skinned blacks at an all-black college. *Do the Right Thing* (1989) focuses on conflicts generated at an Italian American pizza parlor in a black Brooklyn neighborhood. *Jungle Fever* (1991) concerns a romance between a black man and a white Italian American woman, as well as drug problems in the black community. *Malcolm X* (1992) is a biography of the black leader assassinated in 1965. *Crooklyn* (1994) is a nostalgic look back at Lee's childhood in New York City. *Clockers* (1995) explores violence and drug dealing in a poor black community. Lee's other feature films include *She's Gotta Have It* (1986), his first; *Mo' Better Blues* (1990); *Get on the Bus* (1996); *He Got Game* (1998); and *Summer of Sam* (1999). Lee also directed *Four Little Girls* (1997), a feature-length documentary that deals with the deaths of four black girls in a church bombing in Birmingham, Alabama, in 1963. Lee also acts in his own films. He has produced and performed in television commercials and has directed music videos.



© F. Darmigny, Sygma

Spike Lee

Lee was born in Atlanta, Georgia. He grew up in New York City. His full name is Shelton Jackson Lee.

Robert Sklar

Lee, Tsung Dao (1926-), shared the 1957 Nobel Prize in physics with Chen Ning Yang. They proposed that the "conservation of parity," a basic principle of nuclear physics, did not hold true in some cases (see **Parity** [physics]). Since 1979, Lee has worked to promote academic exchange between physicists of China and the United States. Lee was born in Shanghai, China. He attended Chinese universities and the University of

Chicago, where he received a Doctor of Philosophy degree in 1950. Tian Yu Cao

Lee Kuan Yew, *lee kwahn yoo* (1923-), was prime minister of Singapore from 1959 until 1990. Under Lee's rule, Singapore became one of the most prosperous countries in Asia. His government exercised strong control over the nation's economy and political system. In 1990, Lee resigned as prime minister and was succeeded by Goh Chok Tong. But Lee remained an important political figure. He served as head of his political party until 1992 and as a senior minister in Goh's Cabinet.



Reuters/Bettmann Newsphotos
Lee Kuan Yew

Lee was born in Singapore. He attended Raffles College in Singapore, and, in 1949, graduated from Cambridge University in England with a law degree. Lee returned to Singapore in 1951 and became a labor lawyer. He helped found the People's Action Party, Singapore's dominant political party, in 1954. Lee became prime minister in 1959, when Singapore gained self-government for its internal affairs. He remained as prime minister from 1963 to 1965, while Singapore was part of the Federation of Malaysia. Lee continued in that position after Singapore became an independent country in 1965. L. A. Peter Gosling

Lee Teng-hui, *lee duhng HWEE* (1923-), served as president of the Republic of China (Taiwan) and chairman of the country's Nationalist Party from 1988 to 2000. In 1988, Lee, then vice president, succeeded Chiang Ching-kuo, who had died. In 1990, Taiwan's National Assembly elected him president. In 1996, Lee was elected by the Taiwanese people in the country's first democratic presidential election. As president, Lee furthered democratic reform and increased Taiwan's contacts with other countries. Lee did not run for reelection in 2000. The Nationalist Party's presidential candidate lost the election, and Lee resigned as head of the party.



AP/Wide World
Lee Teng-hui

Lee was born in Sanchih, near Taipei. He received a doctoral degree in agricultural economics from Cornell University in the United States in 1968. He taught at National Taiwan University before becoming an agricultural specialist for the Taiwanese government. In 1972, he became a minister of state. He was appointed mayor of Taipei in 1978, and provincial governor in Taiwan in 1981. In 1984, President Chiang chose him as his vice president. Arif Dirlik

Leech, also called *bloodsucker,* is a worm that has a disklike sucker at each end. It has a mouth centered in the front sucker, and may also have small teeth. Some leeches live as parasites, sucking on the blood and tissue of other animals for nourishment. Others feed on decaying animal and plant material. Parasitic leeches attach to their victim with the front sucker, make a wound, and then suck out blood. Blood-sucking leeches produce a liquid containing a chemical substance called *hirudin.* Hirudin prevents the blood from thickening and makes it easier for the leech to suck the blood.



© Frithfoto from Bruce Coleman Ltd.
A parasitic leech sucks human blood through a mouth centered in a disklike front sucker. The leech has a similar sucker on the other end of its body.

Doctors once commonly used what they called *medicinal leeches* to remove blood in the treatment of many illnesses. Today, doctors occasionally use leeches to reduce the accumulation of blood in tissues after plastic surgery and after severed fingers or hands have been surgically reattached.

A leech's body is made up of a series of ringlike *segments* (parts). Leeches may be from $\frac{3}{4}$ to 8 inches (2 to 20 centimeters) long and can stretch or shorten their bodies. They are black, red, or brown and may have stripes or spots. They have clusters of light-sensitive cells called "eyes" near the front end. They are also sensitive to touch, temperature, and drying. A leech contains both male and female reproductive organs.

Leeches live in damp places, such as the moist soil or vegetation of jungles. They are also found in the shallow water of streams, lakes, or oceans. David F. Oetinger

Scientific classification. Leeches make up the class Hirudinea of the phylum Annelida. Members of the genus *Haemadipsa* are the troublesome land leeches of the jungle. The medicinal leech is *Hirudo medicinalis.*

Leechee. See Litchi.

Leeds (pop. 674,400; met. area pop. 1,984,700) is the center of the clothing industry of West Yorkshire in England, one of the four divisions of the United Kingdom. The city is also an important producer of wool textiles. It lies in the north-central part of England on the River Aire. For location, see **England** (political map). The important Yorkshire coal field lies to the south and southeast of Leeds. The field provides coal for several power stations in the region. Leeds is connected with the east coast of England by the River Aire.

Clothing and wool textiles are the traditional products made in Leeds. In addition, Leeds has developed important computer, defense, electronic, engineering, and vehicle industries. The city is a major cultural and business center and the home of the University of Leeds.

The site of Leeds was inhabited as early as the 600's. The organization of the early settlements was rural, and no town existed at what is now Leeds until after the Norman Conquest of 1066. M. Trevor Wild

Leek is a vegetable related to the onion. The leek plant has many flat leaves that join together at their base to form a thick stem. The stem measures 1 to 2 inches (2.5 to 5 centimeters) wide and 5 to 8 inches (13 to 20 centi-



WORLD BOOK illustration by Jill Coombs

The leek, a variety of onion, has a slender white bulb at the base of the leaves. A purple flower cluster blooms in the spring.

meters) long. The stem is the edible part of the plant, and it has a mild, onionlike flavor. It is eaten raw, or it is cooked or used as a seasoning for other foods.

Leeks are *biennial* plants—that is, they live for two years. The plants are grown from seeds, and they require a long growing season. Leek seeds are generally planted in a greenhouse or hotbed in the early spring. In late spring, the seedlings are transplanted to a field or garden. Rich, fertile soil is packed around the stem to improve the quality of the plant.

Leeks probably originated in the eastern Mediterranean Sea region. Today, they are popular in northern European countries. However, leeks have little commercial value in other areas. George R. Hughes

Scientific classification. The leek belongs to the Amaryllis family, Amaryllidaceae. Its scientific name is *Allium porrum.*

Leeuwenhoek, *LAY vuhn hook,* **Anton van** (1632-1723), a Dutch amateur scientist, was one of the first people to record observations of microscopic life. He provided the first clear descriptions of bacteria.

Leeuwenhoek was born in Delft, the Netherlands. He earned his living as a cloth merchant and made his first microscopes to help inspect the quality of cloth. His simply constructed microscopes were among the most powerful of his day. His best surviving microscope magnified objects with clarity up to 270 times their actual size.

In 1674, Leeuwenhoek concluded that the moving objects he viewed through his microscopes were tiny animals. Beginning in 1676, he wrote approximately 30 letters to the Royal Society in London in which he described several types of these microorganisms. Leeuwenhoek called the microorganisms *animalcules.* They included what are now known as bacteria, protozoa, and rotifers.

Leeuwenhoek hoped that his discovery of the animalcules would disprove the widely believed theory of *spontaneous generation.* This theory held that lower forms of life, such as worms and lice, originated from nonliving matter. To challenge this belief, Leeuwenhoek studied the sperm of several kinds of animals as well as the life cycles of mites, lice, and fleas. His studies contributed to the abandonment of the theory of spontaneous generation in the mid-1800's.

Leeuwenhoek was also interested in the ways animals and plants transport nutrients. He studied the blood of fish, birds, tadpoles, and mammals, including human beings. In 1674, he became the first person to correctly describe red blood cells. In plants, Leeuwenhoek showed how sap moves through a network of channels, or *vessels.* He also revealed the complex structures of roots, stems, and leaves. John Scarborough

See also Medicine (History).

Leeward Islands, *LEE wuhrd* or *LOO uhrd,* lie in the West Indies. They stretch from Puerto Rico to the Windward Islands and form part of the Lesser Antilles. For the location of the Leeward Islands, see **West Indies** (map). The islands were named *Leeward* because they are sheltered from the trade winds. The word *lee* is a sailing term referring to the side of a boat that is sheltered from the wind.

The Leeward Islands include about 15 islands and many islets. They have an area of 1,542 square miles (3,994 square kilometers). The Leeward group includes two independent countries: Antigua and Barbuda, and St. Kitts and Nevis. The group also includes Anguilla, the British Virgin Islands, and Montserrat, which are overseas territories of the United Kingdom; St. Eusatius, Saba, and the southern part of St. Martin, which are Dutch territories; Guadeloupe, a French overseas department; and the Virgin Islands of the United States, a U.S. territory.

The climate varies, but it is generally dry and healthful. Most of the people are farmers or fruit growers. The main products of the islands include tobacco, cotton, onions, coconuts, tomatoes, limes, pineapples, sugar, and dairy products. Gustavo A. Antonini

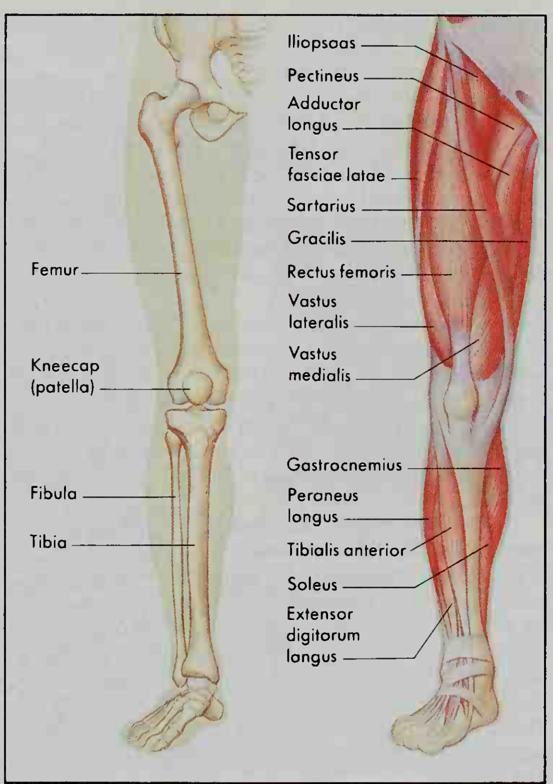
See also **British West Indies; Guadeloupe; Virgin Islands; West Indies; Windward Islands.**

Left-handedness. See **Handwriting.**

Left wing is a term that means a radical party or branch of a political group. The term originated in the first French legislature after the French Revolution. The conservative representatives were seated to the right of the speaker, and the more radical deputies were seated to the left. Later, people throughout the world used the terms *left* and *right* to denote two opposing political beliefs, radical egalitarianism and conservatism. In general, the left has valued equality more highly than individual freedom, while the right has valued liberty more highly than equality. Today, the left wing is often identified with socialism or Communism. Christopher Lasch

Leg is the limb that supports the body of a human being or animal. Properly, it is only that section of the lower limb between the ankle and the knee. The part of the limb between the knee and hip is called the *thigh.* In human beings, the thigh contains the *femur,* the longest, strongest bone of the body. The femur meets the hipbone at the hip joint. The hip joint is a ball-and-socket joint that allows a person to move the limb freely, but also provides the stability needed to bear the weight of the body. See **Hip.**

The thigh. Muscles attached to the bones by *tendons* (strong cords of tissue) make it possible for people to move their limbs. The front of the thigh consists of a



WORLD BOOK illustrations by Robert Demarest

The leg contains large, strong bones, *left,* which support the weight of the body. Powerful leg muscles, *right,* permit such movements as walking, jumping, climbing, and kicking.

four-parted muscle, the *quadriceps femoris.* This muscle allows a person to straighten the limb at the knee, and to bend the thigh at the hips. Three long muscles, called the *hamstring muscles,* allow a person to bend the knee and straighten the thigh. The length of the hamstrings varies considerably among people. In some people, the hamstrings will not stretch enough to allow the person to touch the toes with the fingers. In others, the hamstrings are long, allowing the person to touch the floor with the palms or to do a high kick. The tendons of these muscles connect with the leg bones and can easily be felt on either side of the leg behind the knee. The quadriceps femoris and hamstring muscles are chiefly used for walking, running, kicking, and climbing.

The leg, or lower part of the limb, contains two bones. These are the *tibia* (shinbone), which can be felt close to the middle front section of the leg, and the *fibula* in the muscles of the side of the leg.

Seven muscles make up the *calf* (fleshy part of the back of the leg). The *gastrocnemius* is the most prominent. These muscles allow a person to bend the toes and to raise the body on the balls of the feet. The *tendo calcaneus*, or *Achilles' tendon,* connects the gastrocnemius and two other calf muscles to the heel bone. This tendon forms the prominent ridge on the back of the leg, extending upward from the heel to the lower calf. Four muscles on the front of the leg bend the foot upward and straighten the toes. Two additional muscles near the fibula bend the foot sideways.

The knee joint, between the femur and tibia, acts like a hinge. It also allows a little movement from side to side. The *patella* (kneecap) is a triangular bone in front of the knee joint. It acts as a pulley for the tendon of the quadriceps femoris muscle.

Blood and nerve supply. The *femoral artery* is the main artery that carries blood to the lower leg. It runs down the front of the thigh, then travels behind the knee, where it becomes the *popliteal artery.* Finally, it branches to form the arteries of the leg. The largest nerve of the entire body, the *sciatic nerve,* extends down the back of the thigh to the leg and foot. The sciatic nerve supplies the nerves for the skin of the foot and most of the leg, for all of the foot and leg muscles, and for the muscles on the back of the thigh.

John R. Conway III

Related articles in *World Book* include:

Achilles' tendon	Human body (Trans-Vision)	Ligament
Ankle	Joint	Muscle
Foot	Knee	Tendon

Legacy, *LEHG uh see,* is a disposition of personal property made by the terms of a will. *Specific legacies* are gifts of particular pieces of property, such as jewelry, books, or clothing. *General legacies* are usually sums of money. *Residual legacies* are what remains of a person's estate after the specific and general legacies have been paid. For example, a man leaves bequests to his friends and servants, and states that the residue of his estate is to be divided among his family (see **Will**).

Before any legacies are given out, the debts of the dead person must be paid. Next, the specific legacies are paid out, and then the general legacies. The residual legatees divide what remains. Sometimes a person's estate is exhausted in paying claims and the legatees named in the will receive nothing. William M. McGovern

Legal age. See **Minor.**

Legal aid is the name of any of several programs that provide legal service for people who cannot afford an attorney. In the United States, legal aid agencies are sponsored by charitable organizations; law schools; lawyers' associations; and the federal, state, and local governments. The federal government provides funds to help support some government and private legal aid organizations.

Agencies furnishing legal aid handle chiefly *civil cases.* Such cases involve such matters as adoptions, bankruptcies, divorces, and job and rent disputes. Congress has prohibited legal aid agencies from using federal funds in *criminal cases.* These cases involve actions considered harmful to society. Many states employ lawyers who serve as *public defenders* in criminal cases (see **Public defender**).

The first legal aid agency in the United States was established in 1876 by the German Society, an organization in New York City. The society set up the agency to help German immigrants with legal problems. Lawyers' associations in many cities have set up legal aid programs during the 1900's. In 1911, an organization was founded to furnish legal aid to the needy. This group is now called the National Legal Aid and Defender Association. It publishes information and holds conferences for workers in the legal aid field.

In 1964, Congress set up the Office of Legal Services as part of the War on Poverty program of President Lyndon B. Johnson. This agency helped organize legal aid programs in many states. In 1974, Congress dissolved the Office of Legal Services and transferred its functions to a private, nonprofit corporation, the Legal Services Corporation. This agency provides funds, information, and training programs for legal aid agencies. The United States has about 1,600 of these agencies.

Ronald R. Davenport

Legal tender is any type of money that must, by law, be accepted in payment of a debt. The Legal Tender Act of 1933 gave unlimited legal-tender power to all United States currency in circulation.

Before 1933, gold coins and certificates had unlimited legal-tender power. Standard silver dollars had full legal-tender power, unless they were specifically declared unacceptable by contract. United States notes (greenbacks) were legal tender for all purposes except payment of customs duties and interest on the public debt. All other forms of paper money—whether issued by the United States Treasury, the Federal Reserve Banks, or private commercial banks—had legal-tender status for payment of taxes, but not for the settlement of private debts. Half dollars, quarters, and dimes were legal tender for amounts not more than $10. Nickels and cents were legal tender only for amounts not more than 25 cents.

Most other nations restrict the legal-tender power of coins in fractional denominations of the monetary unit. For example, the Canadian Currency Act makes coins of 10 cents or more legal tender for amounts not exceeding $10; 5-cent coins legal tender for amounts not exceeding $5; and 1-cent coins legal tender only for amounts of 25 cents or less. R. G. Doty

Legation, *lih GAY shuhn,* is a diplomatic mission from one nation to another that is headed by a minister. Ministers rank below ambassadors. Before World War II (1939-1945), most nations maintained legations abroad rather than embassies. Since the end of World War II, many countries have replaced their legations with embassies. The United States has not had a legation since 1966. Robert J. Pranger

See also **Ambassador; Minister.**

Legend. See **Map** (Map legends).

Legend is a type of folk narrative. In some ways, legends resemble *myths.* But myths typically relate events from a remote time long ago and deal with such religious subjects as gods and goddesses and the origin of the universe. Legends are set in the present or in the historical past. Although legends may have religious implications, most are not religious in nature. Legends distort the truth, but they are based on real people or events.

Every society produces legends. They constitute an unofficial or folk history by reflecting the attitudes and values of the group that creates them. In addition, legend heroes possess exaggerated attributes—positive or negative—of special significance to a society. For example, many legends tell about George Washington or Abraham Lincoln. Such legends emphasize the courage and fairness of these great Presidents of the United States.

The majority of societies have both local and national legends. Local legends tell about heroes of a particular ethnic group, occupation, or region. For example, John Henry is a legendary hero of African Americans, and Casey Jones has the same rank among railroad engineers. National legends are shared by an entire people. Many British men, women, and children take pride in the achievements described in the tales of King Arthur and his Knights of the Round Table. Urban legends are an increasingly common form of folk narrative. They reflect the anxieties of modern urban living.

Mark E. Workman

See also **Folklore** and its list of *Related articles;* **Literature for children** (Folk literature).

Léger, *lay ZHAY,* **Fernand,** *fehr NAHN* (1881-1955), was a French artist who developed a distinctive style that expresses the dynamics and tension of modern life in an industrialized society. Léger's works feature cylindrical and tubular shapes that have a machinelike quality. Léger's subjects include such mechanical devices as machine cogs and railway wheels and such human subjects as construction workers and mechanics.

Léger was born in Argentan, near Alençon. His early paintings show the influence of the cubist movement. Beginning in the early 1940's, Léger enclosed his forms with heavy black lines that gave his pictures a posterlike simplicity. In some later pictures, he painted outlined figures and objects over abstract color patterns. Throughout his career, Léger showed an interest in forms of popular culture such as the circus, shop window displays, and billboards. Nancy J. Troy



Detail of oil painting on canvas (1920); Musée Nationale Fernand Léger, Biot, France (Granger Collection)

Fernand Léger's *The Mechanic* shows how the artist used cylindrical forms to express his fascination with modern machines.

Léger, *lay ZHAY,* **Jules,** *zhool* (1913-1980), was governor general of Canada from 1974 to 1979. During his term, Léger devoted much time to strengthening relations between French- and English-speaking Canadians. He also worked to promote Canadian culture. Despite suffering a stroke early in his term, Léger traveled widely to meet with cultural and volunteer organizations.

Léger was born in St.-Anicet, Que., near Montreal. He studied law at the University of Montreal and literature at the University of Paris. Léger then taught diplomatic history at the University of Ottawa during the late 1930's and joined the Canadian foreign service in 1940. He became the Canadian ambassador to Mexico in 1953, and later served as ambassador to Italy, France, Belgium, and Luxembourg. Léger was undersecretary of external affairs from 1954 to 1958 and undersecretary of state from 1968 to 1973. Jacques Monet

Legion was a division of the Roman army. Its size varied from about 4,000 to 6,000 men during different periods of Roman history. After Rome became an empire, a general chosen by the emperor commanded each legion. Six young commissioned officers called *military tribunes* served under him. But the 60 veteran noncommissioned officers called *centurions* were the most effective and important leaders. Each centurion led a *century* (a unit of about 100 men).

Before the late 100's B.C., legions were divided into *maniples* of 120 men each. On the battlefield, a legion formed into three rows of maniples, with the maniples positioned like the black squares on a checkerboard. Spaces as wide as a maniple were left between the maniples. This arrangement proved effective against masses of invading warriors and against enemy forces advancing in tight ranks. The men in the front row of maniples hurled their spears at the enemy, then attacked with drawn swords. The second row of maniples charged into the empty spaces to relieve their comrades. Finally, the third row advanced with thrusting spears to secure the victory.

In 107 B.C., a general named Gaius Marius rearranged the legions into *cohorts* of about 400 men each. He also opened the legions to men of the lower classes, and an army of loyal, professional soldiers soon developed (see Marius, Gaius). In the early days of the Roman Empire, the army had nearly 30 legions. These formed the backbone of the Roman army. A. J. Busch

See also **Rome, Ancient** (The army).

Legion, American. See **American Legion.**

Legion, Foreign. See **Foreign Legion.**

Legionnaires' disease is an infection that most commonly occurs as pneumonia, with symptoms of fever, cough, chest pain, and difficulty breathing. Legionnaires' disease usually afflicts people who already have another illness—such as lung disease—and those who have received organ transplants.

Legionnaires' disease was first identified in July 1976, when an epidemic of pneumonia struck 221 people attending an American Legion convention in a Philadelphia hotel. Thirty-four of those stricken with the disease died. Physicians did not know what caused the illness, which they named Legionnaires' disease.

In 1977, scientists discovered the cause of the pneumonia, a bacterium later named *Legionella pneumophila.* This bacterium is unusual because it can invade white blood cells and multiply within them. White blood cells normally defend against infections. The bacterium commonly occurs in water supplies. Many outbreaks of Legionnaires' disease have been linked to the presence of the bacteria in drinking water. People get the disease by inhaling water droplets or by *aspirating* (choking on) water containing the bacterium.

Physicians diagnose Legionnaires' disease by testing for antibodies to the bacterium in the blood or by detecting the bacterium in the mucus coughed up from the lungs. The disease can be treated with such antibiotics as erythromycin and rifampin. Legionnaires' disease bacteria in water supplies may be killed by heating the water to high temperatures, by treating it with chlorine or ions from an alloy of copper and silver, or by exposing it to ultraviolet light. Victor L. Yu

Legislative Assembly. See **Canada, Government of** (Provincial and territorial governments); **French Revolution** (The Legislative Assembly).

Legislative calendar. See **Congress of the United States** (Passing a bill).

Legislative department of the United States government. See **Congress of the United States; House of Representatives; Senate; Constitution of the United States** (Article I).

Legislature is the lawmaking branch of a government. In the United States, the national legislature is called the *Congress.* In the United Kingdom and Canada, it is called the *Parliament.* In Japan, it is called the *Diet.* Most legislatures have the power to pass laws (sometimes called *statutes*), which all citizens must obey. Sometimes legislatures have more authority than a government's executive head, and can supervise and regulate the leader's activities.

In parliamentary forms of government, as in the United Kingdom and Canada, the legislature determines the appointment of the prime minister and the cabinet. The ministry can remain in office only so long as it has the support of a majority in the legislature. In presidential systems of government, as in the United States, the country's chief executive is elected for a definite number of years. The chief executive holds office for that length of time even without the support of a majority in the legislature.

Most legislatures today are divided into two separate groups, called houses or chambers. A legislature of two chambers is called a *bicameral* legislature. In the United States, these two chambers are the *Senate* and the *House of Representatives.* In the United Kingdom, they are the *House of Lords* and the *House of Commons.* In Canada, they are the *Senate* and the *House of Commons.* In most two-house legislatures, both houses must approve a bill before it becomes a law. However, in the United Kingdom, only the approval of the House of Commons is necessary to pass any law relating to money matters.

In the U.S. Senate, each state, regardless of population, is equally represented. But members of the U.S. House of Representatives are divided among the states according to their population. Most state legislatures resemble the national legislature in organization and method of operating. But Nebraska has a one-house legislature chosen on the basis of population. A one-house body is known as a *unicameral* legislature. In 1964, the

Supreme Court of the United States ruled that representation in both houses of state legislatures must be based on population.

Most national legislatures hold a regular session each year. Special sessions may be called to meet problems that come up between the regular sessions. In the United States, over four-fifths of the state legislatures hold yearly sessions. The other states meet every two years. But any of these state legislatures may be called into special session when the need arises.

The members of legislatures are elected to office for a varying number of years. Members of the U.S. Senate are elected to six-year terms, and members of the House of Representatives are elected to two-year terms. For information on the terms of state legislators, see the *Legislature* sections of the state articles, such as **Alabama** (Legislature).

In cities, the legislature is usually called the *board of aldermen, common council,* or *city council.* In some cities, the legislature is called the *commission.* Laws passed by city legislatures are usually called *ordinances.*

Kenneth Janda

Related articles in *World Book* include:

Le Guin, *luh GWIHN,* **Ursula K.,** *UR suh luh* (1929-), is an American author of science fiction and fantasy for children and adults. Many critics consider her fantasy adventures, which are popular with both children and adults, as her best writing. These works include her most popular works for children, the *Earthsea* trilogy. The three novels consist of *A Wizard of Earthsea* (1968), *The Tombs of Atuan* (1971), and *The Farthest Shore* (1972). These books describe the adventures of Ged, who, as a boy and adult, struggles with the forces of good and evil in the imaginary land of Earthsea. Le Guin continued the story in the novels *Tehanu: The Last Book of Earthsea* (1990) and *The Other Wind* (2001), and in the short-story collection *Tales from Earthsea* (2001).

Le Guin's finest novels for adults include *The Left Hand of Darkness* (1969) and *The Dispossessed* (1974). Many of her short stories appear in *The Wind's Twelve Quarters* (1975) and *Orsinian Tales* (1976). Her essays on science fiction and fantasy were published in *Language of the Night* (1979). *Dancing at the Edge of the World* (1989) is a collection of her essays, speeches, and reviews. Ursula Kroeber Le Guin was born on Oct. 21, 1929, in Berkeley, California. Jill P. May

Legume, *LEHG yoom* or *lih GYOOM,* is any of the plants that belong to the pea family. They make up the second largest family of flowering plants. The composite family is the largest (see **Composite family**). Botanists recognize between 14,000 and 17,000 *species* (kinds) of legumes. The group gets its name from the *legumes* (seed pods) that the plants bear.

Many legumes are of great economic importance throughout the world. Such legumes as peas, beans, and peanuts are valuable foods. Alfalfa, clover, and vetch are important forage and pasture plants. Other legumes yield medicines, dyes, oils, and timber.

Legumes grow in most parts of the world. They vary widely and may be trees, shrubs, or herbs. Many legumes are climbing plants. The flowers of one large subfamily of legumes look like butterflies. Botanists call this group *Papilionoideae,* from the Latin word for *butterfly.* The common sweet pea belongs to this group. The flowers of other legumes may be small and regular. The flowers of still others may be irregular, with spreading petals.

Legumes take nitrogen into their roots from the air. Certain bacteria, called *rhizobia,* live in *nodules* (knotlike growths) that form along the roots of the plants. These bacteria take nitrogen from the air and change it into forms that can be used by plants. This characteristic makes leguminous plants valuable in agriculture. Farmers often use them as green manure and as cover crops to improve poor soil (see **Nitrogen**).

Each plant mentioned in this article has a separate article in *World Book.* Daniel F. Austin

Scientific classification. Legumes make up the pea family, Leguminosae or Fabaceae.

Lehár, *LAY hahr* or *LEH hahr,* **Franz,** *frahnts* (1870-1948), was the most important composer of operettas of the 1900's. His *The Merry Widow* (1905) is the most popular operetta in music history. Lehár's music is known for its interesting melodic development, colorful orchestrations, and skillful musical and dramatic use of counterpoint.

Lehár's other important operettas include *The Count of Luxembourg* (1909) and *The Land of Smiles* (1929). Lehár also wrote an opera, *Giuditta* (1934). His instrumental compositions include 3 symphonic poems; about 65 dances, primarily waltzes; 2 violin concertos; and more than 50 marches. Lehár was born on April 30, 1870, in Komárom, Hungary, but spent much of his career in Vienna, Austria. Charles H. Webb

See also **Operetta**.

Le Havre, *luh HAH vruh* (pop. 193,259; met. area pop. 248,547), is the second busiest seaport city in France—after Marseille—and a major industrial center. It lies along the English Channel, in northern France, at the mouth of the Seine River. For the location of Le Havre, see **France** [political map]).

Le Havre's port and downtown area were badly damaged during World War II (1939-1945). After the war, they were rebuilt according to a master plan. The port was equipped with excellent facilities that can accommodate very large vessels. Many modern buildings were constructed in the downtown area. Much of France's crude petroleum is imported at Le Havre. The city's many industries include shipbuilding, automobile assembling, and the production of chemicals, electrical goods, machine tools, and petrochemicals.

Le Havre was founded as a seaport in the 1500's. The city soon became a major French center of international trade and industry. Le Havre has maintained its importance in France's economy ever since. Mark Kesselman

Lehmann, *LAY muhn,* **Lotte,** *LAW tuh* (1888-1976), a German soprano, won fame as a concert and opera singer. A sensitive, warm-hearted artist, she was known as an outstanding interpreter of the music of Richard Wagner and Richard Strauss. One of her most celebrated roles was the Marschallin in Strauss's *Der Rosenkavalier.* She is also remembered for her singing of the German art songs called *lieder.* Lehmann was born in Perleberg. She settled in Santa Barbara, Calif., in 1938. She became a United States citizen in 1945.

Martin Bernheimer

Lehmbruck, *LAYM bruk,* **Wilhelm,** *VIHL hehlm* (1881-1919), was a German sculptor. In 1910, he settled in Paris, where he became influenced by the work of French sculptor Aristide Maillol. Lehmbruck's early works are robust, classically proportioned figures with sad, meditative expressions. About 1911, Lehmbruck changed his style based on Gothic and other influences. He preferred to work in stone and bronze. His figures became long, slender, graceful, and frequently larger than life size. Their gestures and faces are expressive, often conveying sadness or anxiety. The attitude of despair found in Lehmbruck's late work reflects the depression that led to his suicide. Lehmbruck was born near Duisburg. Joseph F. Lamb

Lei. See **Hawaii** (Clothing; pictures).

Leibniz, *LYP nihts,* **Gottfried Wilhelm,** *GOHT freet VIHL helm* (1646-1716), was a German philosopher, mathematician, and scholar. He and Sir Isaac Newton independently developed the theory of the differential and integral calculus (see **Calculus**). Leibniz also developed the binary numeration system and invented a calculating machine. He believed the truths of arithmetic could be derived from purely logical principles.

Leibniz developed a complex philosophical system. He believed that the ultimate elements of reality are indivisible, mindlike substances called *monads.* He identified the changing states of monads as "perceptions." But Leibniz thought only those monads that are true minds—divine, angelic, human, or animal—could perceive consciously. Leibniz said monads are "windowless"—that is, their states are generated from within the monad itself rather than being caused from without.

Although monads do not interact causally with each other, Leibniz believed that God created the world in such a way that the perceptions of any monad are "harmonized" with all others. In this and other ways, the world that God has chosen to create is the "best of all possible worlds." God can conceive of other worlds that would be better than this world in some ways. However, such other worlds would necessarily be worse in other ways. Material objects are not ultimate realities. They are only "appearances" arising from the perceptions of monads (see **Philosophy** [Rationalism]).

Leibniz was born in Leipzig. He traveled extensively in Europe on various diplomatic missions for German rulers. He died in Hanover, where he spent much of his later life. Margaret D. Wilson

Leicester, *LEHS tuhr,* is an industrial and historic city in central England. It is the largest city in the district of Leicester, which has a population of 282,900. For location, see **England** (political map).

The center of Leicester includes a modern shopping and business district, a bustling marketplace, and the University of Leicester. Nearby, Jewry Wall—part of public baths built by Romans during the A.D. 100's—stands next to a modern hotel. Other landmarks include churches and the remains of a castle that date from the 1100's. Leicester factories produce a variety of goods, including hosiery, shoes, and engineering products.

Roman soldiers built a fort on the site of what is now Leicester shortly after they began the conquest of Britain in the A.D. 40's. During the Middle Ages, Leicester gained importance as a center of the wool trade. It became a prosperous industrial city in the 1800's, and has remained so to the present day. Peter R. Mounfield

Leicester, *LEHS tuhr,* **Earl of** (1532?-1588), was an English nobleman and a key advisor to Queen Elizabeth I. He was the fifth son of the Duke of Northumberland. The earl was a favorite of Queen Elizabeth. When his wife was found dead, rumor spread that Leicester had killed her in order to marry the queen. Queen Elizabeth's advisers opposed marriage between Leicester and the queen. Leicester's secret marriage to the Countess of Essex in 1578 angered the queen.

In 1585, Leicester led Queen Elizabeth's expedition to the Netherlands to support the Dutch revolt against Spanish rule. He again angered the queen by accepting the title of Supreme Governor of the Low Countries (now Belgium, the Netherlands, and Luxembourg) without her permission. Leicester's given name was Robert Dudley. His birthplace is not known. Richard L. Greaves

Leiden, *LYD uhn,* also spelled *Leyden* (pop. 114,892; met. area pop. 194,051), lies 22 miles (35 kilometers) southwest of Amsterdam on the Rhine River (see **Netherlands** [map]). It lies 3.8 feet (116 centimeters) below sea level. The city is a center of printing and light industry. Leiden is noted for its many museums. William of Orange founded the Netherlands' first university in Leiden in 1575 to reward the citizens for their heroic defense against a siege by the Spaniards in 1574. Leiden was the home of about 40 of the Pilgrims who sailed to America on the *Mayflower* in 1620. Jan de Vries

Leif Ericson. See **Ericson, Leif.**

Leipzig, *LYP sihg* (pop. 511,079), a city in Germany, is a trade, industrial, and cultural center. The city developed into a prosperous trading center during the Middle Ages because it lay at the intersection of several European trade routes. Leipzig later became world famous for its great trade fairs, and gained a reputation as one of the greatest literary and musical centers of Europe. About a fourth of the city's buildings were destroyed in World War II (1939-1945).

Location and description. Leipzig lies in east-central Germany. It is about 65 miles (105 kilometers) northwest of Dresden (see **Germany** [political map]). The inner part of Leipzig includes the Old City Hall, several churches, and some other buildings that are hundreds of years old. Many historic buildings were damaged during World War II but were restored afterward.

Leipzig's famous trade fairs are held in the center of the city and just outside the city. Leipzig's suburbs include Mockau, Gohlis, Eutritzsch, Möckern, Lindenau, Plagwitz, Connewitz, Stötteritz, Reudnitz, Volkmarsdorf, Schönefeld, and Wahren.

Industry. Leipzig became a center of fur trading early in its history. Later, it grew into a great manufacturing city. Leipzig's industries include woodcarving, paper-



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Leipzig's Old City Hall served as the city hall from 1556 to 1907. It now houses the Museum of the History of the City of Leipzig.

making and the manufacture of many kinds of scientific instruments. The city is a center of textile manufacturing, and also makes steel products, plastics, and processed food products.

Before World War II, Leipzig was the center of German book and music publishing. At one time more than 270 newspapers and magazines were published in the city. Only about 35 of the 400 publishing houses that thrived in Leipzig before the war are still in operation.

Transportation. Leipzig's location at the junction of the Elster, Pleisse, Parthe, and Weisse rivers makes it a great port. A canal connects the city with the Elbe and Saale rivers. Leipzig has two large airports, and is an important railroad and highway hub.

Cultural life. There are many schools, art galleries, and museums in Leipzig. The University of Leipzig was founded in 1409. One of the most famous students at the university was the great German poet Johann Wolfgang von Goethe. Other Leipzig schools include a conservatory founded by the composer Felix Mendelssohn in 1843, an art college, and an academy of graphic and book arts.

Leipzig has played a great part in the history of German music. Johann Sebastian Bach, Robert Schumann, Mendelssohn, and other musical figures lived in the city. The composer Richard Wagner and the philosopher Gottfried Leibniz were born there. The city enjoyed its greatest period as a center of music and literature during the 1800's.

History. Leipzig was chartered in 1174, and became a trade center. Its printing industry dates from around 1480. The city became a battleground during the religious wars of the 1600's. The first Battle of Leipzig was fought near the city in 1631. Swedish forces led by Gustavus Adolphus won a great victory over the German army. The second Battle of Leipzig, fought between the Germans and the Swedes in 1642, also was won by the Swedes. They occupied Leipzig until 1650. In 1813, in the third Battle of Leipzig, Prussia, Russia, Austria, and Sweden defeated Napoleon.

The first major German railroad began operating between Leipzig and Dresden in 1839. After World War II, Leipzig became part of East Germany. East Germany and West Germany unified in 1990. John W. Boyer

Le Mans, *luh MAHN* (pop. 150,605; met area pop. 194,825), is a city in northwestern France. It lies along the Sarthe River (see **France** [political map]).

Le Mans is famous as the site of an annual 24-hour sports car race. The Cathedral of St. Julien is located in the old central section of Le Mans. The cathedral, which was built between the 1000's and 1200's, is noted for its Gothic architecture and its large stained-glass windows. The outskirts of the city have much industry and modern housing.

Le Mans serves as the capital of the Sarthe *department* (administrative district). It is an important grain market and the commercial and railroad center of its region. The city's factories produce agricultural machinery, automobiles, electrical equipment, motors, paper, plastics, textiles, and tobacco products.

Le Mans dates from ancient times. Julius Caesar conquered the area about 50 B.C. A major battle of the French Revolution took place in the city in 1793. In 1871, Prussian armies defeated the French at Le Mans during the Franco-Prussian War. Mark Kesselman

LeMay, Curtis Emerson (1906-1990), commanded the Strategic Air Command of the United States Air Force from 1948 to 1957. During a period in which American foreign policy depended heavily upon the striking power of the Strategic Air Command's long-range bombers, LeMay became one of America's most famous airmen.

In 1957, LeMay became Vice Chief of Staff of the Air Force. He served as Air Force Chief of Staff from 1961 until January 1965, when he retired as a four-star general. In 1968, LeMay was the American Independent Party candidate for vice president of the United States. George C. Wallace was the presidential candidate (see **Wallace, George C.**).

LeMay was born on Nov. 15, 1906, in Columbus, Ohio, and graduated from Ohio State University. He enlisted as a flying cadet in the Army Air Corps in 1928. During World War II, LeMay won attention as a bomber commander in Europe. In 1943, he commanded the Third Bombardment Division of the Eighth Air Force. In September 1944, LeMay took command of the 20th Bomber Command in India.

When the Pacific islands of Guam and Saipan became the main bases for the growing B-29 offensive against Japan, LeMay took charge as the commander of the 21st Bomber Command. From January 1945 until the end of the war, he directed an air assault of mounting intensity against Japan. Stephen E. Ambrose

Lemberg. See Lvov.

Lemelin, *LEHM uh lihn,* **Roger** (1919-), is a French-Canadian author and journalist. Lemelin's first novel, *The Town Below* (1944), is his most famous work. In it, he described in realistic detail working-class life in the city of Quebec. The novel includes ironic treatment of the Roman Catholic clergy and of French-Canadian life in general. Critics considered the novel the beginning of a new style and subject matter in French-Canadian literature. Lemelin wrote his novels *The Plouffe Family* (1948) and *In Quest of Splendor* (1952) in a

style similar to that of *The Town Below.* His famous short story, "The Stations of the Cross," is typical of his fiction in its satiric portrayal of a materialistic priest and his ignorant parishioners.

Lemelin was born in the city of Quebec into a working-class family. He was president and publisher of the newspaper *La Presse* from 1972 to 1980. Sherrill E. Grace

Lemieux, *luh MYOO,* **Mario** (1965-), ranks among the greatest players in the National Hockey League (NHL). Lemieux plays center for the Pittsburgh Penguins. He led the Penguins to the NHL Stanley Cup championship in the 1990-1991 and 1991-1992 seasons. Lemieux led the NHL in scoring six times and twice received the Hart Memorial Trophy as the league's Most Valuable Player.

Lemieux was born in Montreal. He quit school at the age of 16 to play junior league hockey in Canada. The Penguins made him the first selection in the 1984 player draft. In 1985, he received the Calder Memorial Trophy as the NHL's Rookie of the Year. Lemieux was a dominant player despite numerous injuries and a successful battle against Hodgkin's disease, a cancer that mainly affects the lymph nodes. He retired in 1997 and became owner of the Penguins in 1999. He returned as a player with Pittsburgh in December 2000. Dave Nightingale

Lemming, *LEHM ihng,* is a plump little animal related to the mouse. Lemmings live in the cold, northern parts of the world. The best-known kind lives in Scandinavia. Every few years, according to legend, great numbers of lemmings march to the sea and drown themselves. However, scientists no longer believe this. Sometimes there are great increases in lemming populations, and the animals move away from their mountain homes because of crowding. Most of them die of starvation or are killed by other animals.

Lemmings are from 4 to 5 inches (10 to 13 centimeters) long, including their stubby tails. Most kinds of lemmings are gray or brown. Lemmings eat plants. They dig soil to build their nests, which they line with grass and moss. Clyde Jones

Scientific classification. Lemmings are in the New World rat and mouse family, Cricetidae. Lemmings make up the genus *Lemmus.*

See also Animal (picture: Animals of the polar regions).

Lemon is a small, oval, yellow citrus fruit. People in many parts of the world enjoy lemon-flavored foods and lemon-flavored beverages. Lemons have a pleasing scent, and most varieties have a tart taste. Lemons are rich in vitamin C.

The lemon is a type of berry called a *hesperidium.* The most common varieties measure about 3 inches (7.6 centimeters) in length and about 2 inches (5 centimeters) in diameter. Lemons have a bulge at one end. The interior of the fruit consists of 8 to 10 segments, which contain the pulp, juice, and seeds. The leathery yellow outer rind has many tiny glands that contain fragrant oils.

People rarely eat fresh lemons because of the fruit's sour taste. However, lemon juice and oil are used in a wide variety of food products. For example, lemonade, several soft drinks, and many other beverages are made with lemon juice. Such foods as candy, cakes, cookies, and salads, as well as various fish and meat dishes, are flavored with lemon juice and oil. Lemon oil is also used as a scent in various nonfood items, such as household cleaning products, soap, and shampoo, perfume, and other cosmetics.

More than $3\frac{1}{2}$ million tons (3.2 million metric tons) of lemons are grown throughout the world annually. The world's three leading lemon-producing countries are the United States, Argentina, and Italy. Growers in the United States raise about 960,000 tons (871,000 metric tons) of the fruit in a year. California harvests about three-fourths of the nation's lemons. Arizona also produces the fruit. About 60 percent of the U.S. lemon crop is sold as fresh fruit. The rest is processed into juice and oil.

Growing lemons. Lemon trees can reach a height of 22 to 25 feet (6.7 to 7.6 meters). They are very thorny and have long, pointed, pale green leaves. The trees produce purple-tinged white, fragrant flowers. Lemons develop from the ovaries of the blossoms and ripen about 7 to 8 months after the flowers bloom. Lemon trees often have blossoms and fruit at the same time.

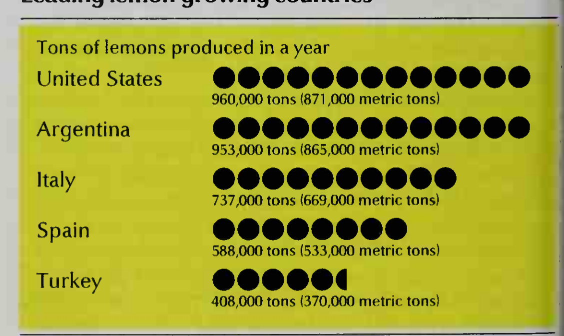
Lemon trees are grown from buds cut from trees that produce the type of lemon desired. The buds are grafted to seedling lemon trees called *rootstocks* (see **Grafting** [Other kinds of grafting]). Rootstock varieties are chosen for their resistance to disease and other reasons. Lemon trees start to produce fruit about two years after grafting, and some continue to bear fruit for 50 years.

Lemon trees may be severely damaged by frost and freezing temperatures, and growers use many methods to protect the trees from cold weather. For example, some growers prevent frost by warming the cold air near the ground with oil-burning heaters. Other growers use large fans called wind machines to mix the cold surface air with the warmer air above it. Water sprays under the trees also help protect against cold.

Lemon trees may also be attacked by such pests as mites, scale insects, and thrips. Mites and scale insects feed on the leaves, fruit, and twigs of the trees. Thrips attack the buds and the fruit. Growers combat such attacks by growing varieties of trees that resist pests and by spraying the trees with insecticides. They also spray orchards with fungicides to fight fungal diseases, which attack the leaves, fruit, and roots of the trees.

Harvesting and processing. Lemon trees bear fruit throughout the year, and growers harvest the fruit 2 to 10 times a year. The largest harvests occur in the autumn and winter. However, lemons are commonly stored for several months for sale in the spring and summer.

Leading lemon-growing countries



Figures are for a three-year average, 1997-1999.
Source: U.S. Department of Agriculture.



WORLD BOOK illustration by Kate Lloyd-Jones, Linden Artists Ltd.



Grant Heilman

The lemon is a popular citrus fruit that is raised mainly for its tart juice and fragrant oil. Lemons are rarely eaten as fresh fruit. Lemon trees bear fruit throughout the year, and so growers harvest the fruit up to 10 times annually.

Lemons to be sold as fresh fruit are picked before they reach full size and maturity. Then they are stored under special conditions so that they are less likely to be damaged during shipment and are more attractive than those shipped immediately after harvest. Decay can be a problem during the marketing of fresh lemons. Blemished lemons and lemons that are too mature at harvest are sent directly to factories for processing.

History. Lemons probably originated in northeastern India, near the Himalaya. The Arabs took them from India to Italy in the A.D. 100's, and to Spain in the 1100's. In 1493, Italian navigator Christopher Columbus planted the first lemon trees in America. By the late 1700's, Spanish missionaries had taken lemon trees to California. The first commercial lemon orchards in the United States were planted in the late 1800's. Wilfred F. Wardowski

Scientific classification. Lemons are members of the rue family, Rutaceae. Commercial lemons belong to the species *Citrus limon.*

See also **Citric acid; Citrus; Fruit** (table).

Le Moyne, *luh MWAN,* **Charles,** *shahrl* (1626-1685), Sieur de Longueuil, was a Canadian colonist and the first of a large family of French-Canadian heroes. The city of Longueuil, Quebec, is named after him.

Le Moyne left France in 1641. In Canada, he lived first at a Jesuit mission with the Huron Indians, where he learned several Indian dialects. Later, he became a fur trader and soldier and one of the richest people in Montreal.



Historical Pictures Service

Charles Le Moyne

The French government honored Le Moyne with many titles, including that of *Sieur de Longueuil,* and gave him large grants of land. Le Moyne encouraged many French settlers to live on these lands and helped them during their pioneer years. He was born in Dieppe, France. He married Catherine Thierry-Primot.

Seven of Le Moyne's sons won fame fighting for France. Two of his sons, Sieur d'Iberville and Sieur de Bienville, explored the gulf regions of the Mississippi River and the river mouth. They claimed the land for France. Sieur d'Iberville served as governor general of the region and, upon his death, Sieur de Bienville succeeded him. Sieur de Bienville founded the city of New Orleans in 1718. John A. Dickinson

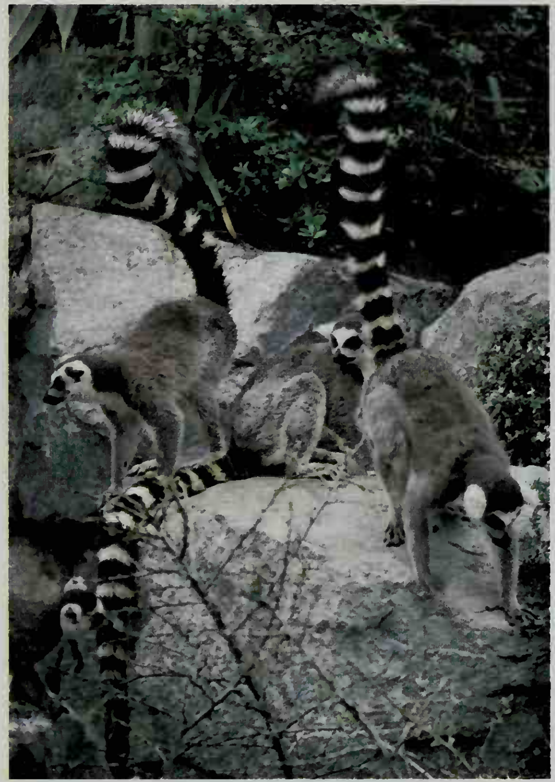
See also **Bienville, Sieur de; Iberville, Sieur d'.**

Lemur, *LEE muhr,* is a long-tailed mammal with fluffy fur. Some kinds of lemurs resemble monkeys. Others look more like mice or squirrels. Scientists classify lemurs, along with human beings, apes, and monkeys, as *primates.* Lemurs live only in Madagascar and Comoros, which are island countries that lie off the southeast coast of Africa.

Most lemurs live in trees most of the time. They eat fruit, leaves, birds and their eggs, and insects and other small animals. Some kinds of lemurs move about chiefly during the day, and others are active at night.

Lemurs vary greatly in size, color, and appearance. The pygmy mouse lemur, the world's smallest primate, weighs about 1 ounce (28 grams) and grows about 8 inches (20 centimeters) long. These brownish or grayish animals look like furry mice. *Ring-tailed lemurs* and *ruffed lemurs* resemble monkeys, except that they have a long pointed snout. The ring-tailed lemur grows 15 inches (38 centimeters) long. It has a gray back, white underparts, and rings of black and white fur on its tail. The ruffed lemur grows 24 inches (61 centimeters) long and has especially fluffy fur. Most ruffed lemurs have a black-and-white coat with a fluffy white *ruff* (collar). Some have reddish-brown fur instead of white. Another kind of lemur, the *aye-aye,* does not resemble any of the other lemurs (see **Aye-aye**).

Two monkeylike lemurs, the *indri* and the *sifaka,* have



Kenneth W. Fink, NAS

The ring-tailed lemur, one of the most common species, lives in the southwest part of Madagascar. Unlike other lemurs, it usually dwells on the ground rather than in trees.

long, powerful hind legs. In the trees, these lemurs spring from trunk to trunk. Most animals that live in trees jump from branch to branch. The indri, the largest kind of lemur, grows about 28 inches (71 centimeters) long. It has a black back and white fur on its undersides. The sifaka grows about 20 inches (51 centimeters) long.

Lemurs have few enemies because there are few large *predators* (animals that eat other animals) in the region where they live. But many species of lemurs have become endangered. People have cut down many trees in the forests in which these animals lived.

Roderic B. Mast and Russell A. Mittermeier

Scientific classification. The pygmy mouse lemur belongs to the family Cheirogaleidae. Its scientific name is *Microcebus myoxinus.* The ring-tailed lemur and the ruffed lemur belong to the family Lemuridae. The ring-tailed lemur is *Lemur catta.* The ruffed lemur is *Varecia variegata.* The indri and the sifaka belong to the family Indriidae. The indri is *Indri indri.* Sifakas form the genus *Propithecus.* A common species is *P. verreauxi.*

Lemur, Flying. See Flying lemur.

Lena River, *LEE nuh,* is the chief waterway of a large district of eastern Siberia, in Russia. The river rises on the slopes of the Baikal Mountains and flows northeast for 2,734 miles (4,400 kilometers). The river empties into the Arctic Ocean through the Laptev Sea. For location, see **Russia** (terrain map). The river's delta is about 250 miles (402 kilometers) wide. Ships can sail up the Lena River for about 2,000 miles (3,200 kilometers).

The Lena River drains an area of about 1 million square miles (2.6 million square kilometers). Its chief branches are the Vitim, Olekma, Aldan, and Vilyuy rivers. Gold is mined along the Vitim and the Aldan. The Lena River basin has large coal and natural gas deposits.

Along its middle course, the Lena River flows through a region that is inhabited by the Yakuts, a Turkic people who fish, farm, and raise livestock. The largest city on the river is Yakutsk. Craig ZumBrunnen

Lenape. See **Delaware Indians.**

Lend-Lease was a plan developed by the United States early in World War II (1939-1945) to aid the countries that were then fighting the Axis powers. The Lend-Lease Act became law on March 11, 1941. It provided that the president of the United States could transfer weapons, food, or equipment to any nation whose fight against the Axis aided the defense of the United States. Under Lend-Lease, billions of dollars worth of American supplies were transferred to the United Kingdom, China, and the Soviet Union. President Franklin D. Roosevelt described the Lend-Lease Act as helping to put out the fire in your neighbor's house *before* your own house caught fire and burned down.

After World War II, no terms were decided upon for the return of goods by countries that received U.S. equipment under the Lend-Lease Act. Some countries, especially the United Kingdom, had already balanced part of the account by furnishing goods and services to U.S. troops. Many people felt that to accept a return of the goods that had been lent would harm U.S. producers. Some people pointed out that all nations fighting the Axis powers contributed everything they could to the war effort. They argued that American Lend-Lease contributions were balanced by the sacrifices of the other Allies. In 1993, however, Russia agreed to pay the Lend-Lease debt of the former Soviet Union and began making payments in 1994. Marc Trachtenberg

Lendl, *LEHN duhl,* **Ivan,** *ee VAHN* (1960-), became one of the world's top tennis players. During his career, he won 94 singles titles. His victories included eight grand slam championships—the United States Open in 1985, 1986, and 1987; the French Open in 1984, 1986, and 1987; and the Australian Open in 1989 and 1990. He held the ranking of number one men's player in the world for a record 270 weeks. Lendl's powerful, disciplined game made him one of the most consistent players.

Lendl was born in Ostrava, Czechoslovakia, in what is now the Czech Republic. He turned professional in 1979. Lendl settled in the United States in the mid-1980's and became a citizen in 1992. He announced his retirement in 1994. J. Norman Arey

L'Enfant, *lahn FAHN,* **Pierre Charles,** *pyair shahrl* (1754-1825), a French engineer and architect, became the first modern city planner in the United States. In 1791, he was commissioned to prepare a plan for the new U.S. capital city in the District of Columbia. His plan envisioned a city of parks, public buildings, and wide, radiating streets. His headstrong temperament led him into a disagreement with President George Washington, and L'Enfant was dismissed as engineer-in-charge in 1792. But his plan formed the basis for the development of Washington, D.C. See **Washington, D.C.**

L'Enfant was born and educated in Paris. He came to America in 1777, and served as an engineering officer in

the Revolutionary War. He designed Federal Hall in New York City (see **Federal Hall**). He spent the later years of his life trying to obtain greater compensation for his work at Washington, D.C. In 1909, Congress erected a monument to him in Arlington National Cemetery, where he is buried. Leland M. Roth

L'Engle, Madeleine (1918-), is an American author best known for her children's books. She won the Newbery Medal in 1963 for *A Wrinkle in Time* (1962), a time travel adventure. She wrote two sequels, *A Wind in the Door* (1973) and *A Swiftly Tilting Planet* (1978). All three novels explore the conflict of good and evil as well as family relationships. L'Engle's other children's novels exploring family life include five about the Austin family—*Meet the Austins* (1960), *The Moon by Night* (1963), *The Twenty-Four Days Before Christmas* (1964), *The Young Unicorns* (1968), and *A Ring of Endless Light* (1980). L'Engle's novels for adults include *The Small Rain* (1945) and *A Severed Wasp* (1983), both dealing with a concert pianist. *A Circle of Quiet* (1972), *The Summer of the Great-Grandmother* (1974), and *Two-Part Invention* (1988) are autobiographies. L'Engle was born in New York City. Nancy Lyman Huse

Lenin, *LEHN ihn,* **V. I.** (1870-1924), founded the Communist Party in Russia and set up the world's first Communist Party dictatorship. He led the October Revolution of 1917, in which the Communists seized power in Russia. He then ruled the country until his death in 1924.

Lenin believed in the theories of Karl Marx, a German social philosopher. According to Marx, the *free enterprise system,* which is based on privately owned business, would eventually destroy itself. At first, industry and businesses would grow, and the owners would get rich. But the owners would pay such low wages to their workers that the workers would be unable to buy the goods that the system produced. As a result, economic depressions would occur. The depressions would worsen until the workers would revolt and take over the industries. Then, the workers would own the factories and the other means of production, and social classes would no longer exist.

Marx believed that such revolutions would occur in Western nations that had highly developed economies. But he was uncertain if Russia would experience a revolution. Lenin, however, was convinced that it would. But according to Lenin, workers and peasants could not carry out a revolution by themselves. He believed that a revolution would succeed only if led by a small political party of professional revolutionaries. This idea was Lenin's most important addition to Marx's social theory. After the revolution, the party would control the government and build a classless Communist society.

Lenin established a pattern for Communist revolutions. First, he used force and terror to take control of the government. Then, he ruled as a dictator, banning all other political parties and all anti-Communist speeches and publications. After coming to power in Russia, Lenin hoped that other Communist revolutions would overthrow the governments of other countries. For this reason, he tried to help Communist movements in other nations. He thus formed and directed an international organization of Communists called the Comintern (Communist International).

Lenin was absolutely devoted to his Communist goals.



Sovfoto

Lenin set up the world's first Communist dictatorship.

But he also dealt realistically with the political problems he faced. For example, Lenin tried to establish peaceful relations with governments opposed to Communism if such governments were too strong to be overthrown. He also permitted some private enterprise in Russia. This policy, known as the New Economic Policy, allowed the nation's economy to recover from its depressed state after the Communist revolution. Lenin despised all religions. But because so many Russian citizens had religious beliefs, he did not try to close all the churches.

Many Communists have considered Lenin and Marx their greatest heroes. The Communists of the Soviet Union, for example, quoted Lenin's words as a basis for their actions. His works are studied in non-Communist countries to provide an understanding of Communism. Lenin is often thought of only as a man of action. Some of his ideas, however, have ranked among the most powerful forces of modern times.

Early life

Boyhood. Lenin was born on April 22, 1870, in Simbirsk (now Ulyanovsk), a quiet town on the Volga River. His real name was Vladimir Ilyich Ulyanov. He adopted the name *Lenin* in 1901. The name may refer to the Lena River of Siberia.

Lenin's father, Ilya Nikolayevich Ulyanov, was a teacher who became director of schools in Simbirsk province. Lenin inherited his father's dark complexion, high cheekbones, and dark brown eyes. His mother, Maria Aleksandrovna Blank, was the daughter of a doctor. She was an educated woman and was deeply devoted to her children. Lenin had two brothers and three sisters. All the children, except one sister who died at the age of 20, became revolutionists.

Lenin had a pleasant childhood. He often imitated his brother Alexander, who was four years older. Lenin

swam, hiked, fished, hunted, and played chess. His sister Anna recalled that he had no close friends.

Education. Lenin learned to read when he was 5 years old. He was taught by a teacher who came to the Ulyanov home. Lenin entered school in 1879, at the age of 9, and became a brilliant student.

During Lenin's youth, Russia was generally quiet and peaceful. The Russian government was an *autocracy,* a system in which one person holds supreme power. Czar Alexander III had come to power in 1881 after the murder of his father, Alexander II. Russia was rapidly becoming an industrial country, though living standards remained low.

In 1886, Lenin's father died. In 1887, Lenin's brother Alexander was hanged for taking part in an unsuccessful plot to kill the czar. The tragedy of Alexander's death deeply influenced Lenin. At his trial, Alexander said he had wanted to kill the czar to gain "political freedom" for the Russian people.

In 1887, the year his brother was hanged, the 17-year-old Lenin finished school. He won a gold medal for excellence in studies. In the fall of 1887, Lenin enrolled in the law school at Kazan University in Kazan. He was expelled three months later for taking part in a student meeting protesting the lack of freedom in the school. Lenin unsuccessfully applied several times for permission to reenter the university. In 1890, St. Petersburg University admitted Lenin as a student, but he was not permitted to attend classes. However, he was allowed to study on his own and to take examinations.

Lenin received a law degree from St. Petersburg University in 1891 and joined a law firm in Samara. By this time, he was absorbed in the study of Marxism. In 1893, Lenin joined a Social Democratic group, a Marxist organization. Later that year, he moved to St. Petersburg and became an active revolutionary. In those days, St. Petersburg was Russia's capital.

Young revolutionist. In St. Petersburg, Lenin soon became a leader of a Marxist, or Social Democratic, revolutionary group. Lenin had the qualifications for leadership. He was highly intelligent and well educated. His writing was accurate, detailed, and clear.

Czar Alexander III died in 1894, and his son, Nicholas II, became czar. Between April and September 1895, Lenin traveled to France, Germany, and Switzerland to contact other Marxists. In December, Lenin was arrested in St. Petersburg by the czar's police while preparing a revolutionary newspaper, *The Workers' Cause.* After being held for questioning for more than a year, Lenin was *exiled* (expelled) to Siberia in 1897.

Exile in Siberia did not mean imprisonment. The government paid Lenin a small allowance, and he rented quarters in Shushenskoye near Abakan. Lenin enjoyed much freedom and continued his revolutionary writings. On July 22, 1898, Lenin married Nadezhda Konstantinovna Krupskaya, another exiled revolutionary. The couple had no children. While in Siberia, Lenin wrote one of his major works, *The Development of Capitalism in Russia* (1899).

Revolutionist leader

Beginnings of revolution. In 1898, while Lenin was in exile, a number of secret Marxist groups in Russia joined and formed the Russian Social Democratic Labor Party. After Lenin's exile ended in January 1900, he got permission from the government to leave Russia. He went to Germany to help found the party newspaper, *Iskra* (Spark). *Iskra* was an illegal paper that had to be smuggled into Russia. The editors of *Iskra* also published *Zarya* (Dawn), which dealt with Marxist theory. It was in *Zarya* in 1901 that Vladimir Ulyanov began using the name *Lenin.* Many revolutionaries changed their names to confuse the police.

In 1902, Lenin wrote *What Is to Be Done?* This pamphlet described his ideas on party organization. In 1903, the Russian Social Democratic Labor Party split into two groups, apparently over a dispute about membership. Lenin became the leader of the *bolshinstvo* (majority), or, as this group came to be known, the *Bolsheviks.* The other group became known as the *menshinstvo* (minority), or *Mensheviks.*

The Bolsheviks wanted party membership limited to a small number of full-time revolutionaries. Lenin and his followers believed that for the revolution to succeed, trained professionals should lead the party, and the party should organize the *proletariat* (workers). The Mensheviks, on the other hand, wanted fewer restrictions on party membership and preferred democratic practices to dictatorship.

Revolt. By the early 1900's, a spirit of revolt against Czar Nicholas II had developed in Russia. The citizens wanted more political freedom, land for the peasants, social legislation and higher wages for the workers, and greater representation in the government. They also wanted an end to the war that Russia was fighting with Japan.

On Sunday, Jan. 22, 1905, Father George Gapon, a Russian Orthodox priest, organized approximately 200,000 people for a peaceful march on the Winter Palace in St. Petersburg. The unarmed marchers planned to present their requests to Czar Nicholas II. Troops fired on the crowd and killed or wounded hundreds of people. This *Bloody Sunday* caused more revolutionary unrest.

By autumn, strikes had paralyzed the country. These troubles led the czar to grant citizens an elected Duma (lower house of parliament) and such basic rights as freedom of speech and the right to vote. The czar also pardoned all political exiles. Lenin returned to Russia in November and called for a general revolt.

Important dates in Lenin's life

1870 (April 22) Born in Simbirsk, Russia.
1891 Graduated from St. Petersburg University.
1897 Exiled to Siberia for political activities.
1898 (July 22) Married Nadezhda Krupskaya.
1900 Returned from exile and went to Western Europe.
1903 Became leader of the Bolsheviks.
1905 Returned to Russia and engaged in revolutionary activity.
1908-1917 Conducted revolutionary activities abroad.
1917 Returned to Russia and led the October Revolution.
1917 (Nov. 8) Became ruler of Soviet Russia.
1918 Shot by Dora Kaplan and recovered.
1918-1920 Led the Bolsheviks in the Russian civil war.
1921 Introduced the New Economic Policy.
1924 (Jan. 21) Died in Gorki, near Moscow.

A mass strike began in Moscow on December 20 and was followed by strikes in other cities. Soon the strike developed into a full-fledged revolution. By the end of December, the revolution was crushed. Years later, Lenin declared that "without the general rehearsal of 1905, the victory of the October Revolution of 1917 would have been impossible."

Outcast. From 1906 to 1908, Lenin spent most of his time writing revolutionary pamphlets and attending party congresses in England, Germany, and Sweden. Lenin found it too difficult to carry on revolutionary activities in Russia. After two years in Finland, he went to Switzerland and then to France. His main purpose was to keep the Bolshevik organization together. Lenin also tried to further the separation between the Bolsheviks and the Mensheviks. He claimed that the Mensheviks were not real revolutionaries.

In April 1912, in St. Petersburg, several Bolsheviks established *Pravda* (Truth), a revolutionary newspaper that was sold openly. To be closer to Russia, Lenin moved to Kraków (then in Austria-Hungary, now in Poland) and became *Pravda*'s chief contributor.

World War I began during the summer of 1914. Germany declared war on Russia on August 1. The Austrian government arranged for Lenin to go to Switzerland, which did not take part in the war.

Some Russian revolutionaries wanted a Russian victory. Others wanted peace without victory for any country. Lenin said that he wanted Russia to lose the war because a defeat for Russia would bring about a revolution in that country. The German government secretly gave financial help to Lenin's party. By this means, the Germans hoped to weaken the Russian war effort.

The road to power

The February Revolution. By 1917, Russia had lost many battles in the war. Unrest in the nation mounted, and food shortages were unchecked. The value of Russian money went down. Early in March (February on the old Russian calendar), bread supplies ran short in the capital (which had been renamed Petrograd in 1914). Long lines of women appeared before the bread shops. Russian workers went on strike. By March 9, about 200,000 strikers were demonstrating in Petrograd. The soldiers refused to maintain order. *Soviets* (councils) of workers and soldiers had sprung up in Russia during the revolution of 1905. On March 12, 1917, a group called the Soviet of Workers' and Soldiers' Deputies was established in Petrograd.

Czar Nicholas II gave up the throne on March 15, and a democratic government was established. Prince George Lvov, a Russian political leader, became prime minister. For a time, the Petrograd soviet shared control of Russia with the government. However, the Bolsheviks soon demanded that all governing power be given to the soviets.

Return from exile. The Bolsheviks were disorganized at the time of the February Revolution. Some of them wanted to accept the Lvov government and end the feud with the Mensheviks. Others opposed both the Lvov government and the Mensheviks.

Lenin, who was still in Switzerland, sought to return to Russia. The Germans were willing to allow Lenin to travel through Germany on the way to Russia. However,



Keystone

Lenin's powerful speeches persuaded the Russian people to follow his leadership. Leon Trotsky, also a Bolshevik leader, stands on the platform steps.

they also were afraid that, while in Germany, Lenin might stir up German workers. For this reason, the Germans made Lenin stay inside a single railroad car while he traveled through Germany. On April 16, 1917, Lenin arrived in Petrograd. He received a hero's welcome from the people.

In Petrograd, Lenin called for the overthrow of the Lvov government and for an end to Russia's participation in World War I. Lenin quickly regained leadership of the Bolsheviks, but he was unable to seize control of the Lvov government. In July 1917, following an unsuccessful Bolshevik uprising, the government was reorganized under Alexander Kerensky. On July 19, the Russian government ordered Lenin's arrest as a German agent. Lenin fled to Finland, and his followers escaped or were jailed.

While living in Finland, Lenin wrote *The State and Revolution* (1917), one of his most important works. He told how to organize a revolution and what kind of government to establish after the power had been seized. In September 1917, Lenin wrote the leaders of the Bolsheviks and declared that the time for speechmaking was over. It was time for action. "History will not forgive us if we do not assume power now," Lenin said.

The October Revolution. In October 1917, Lenin returned to Petrograd. He urged the Central Committee to begin a revolt immediately. Kerensky's government and leadership were weak. Leon Trotsky, the Bolshevik president of the Petrograd soviet, got control over some government troops. Naval crews also agreed to support the revolt. The Bolsheviks decided to act.

With little violence, the Bolsheviks seized Petrograd on November 7 (October 25 on the old Russian calendar). Kerensky fled. The struggle for Moscow was more violent than in Petrograd, but by November 15, the Bolsheviks also held that city. Henceforth, the Bolsheviks controlled the Russian government. They had come to power with the help of a simple slogan: "Bread, peace, land." This slogan had little to do with the theories of Marx. But it had real meaning to starving housewives

and their families, soldiers sick of war, and peasants hungry for land.

Lenin the dictator

The Second All-Russian Congress of Soviets opened on Nov. 8, 1917, with delegates from most parts of the country. The congress, controlled by the Bolsheviks, appointed a Council of People's Commissars. Lenin was made chairman of the council and thus became head of the new Russian state. At Lenin's first appearance before the congress, he requested permission to ask Germany for a three-month truce. He also asked for the abolition of private landownership. The congress approved both requests. The Bolsheviks started peace talks with Germany, and *nationalized* (put under government control) all privately owned land.

Lenin hardly had time to begin nationalizing industry, banks, and private business, when he found himself battling to stay in power. The Russian Army had fallen apart, the Germans were advancing into Russia, and forces that opposed the Bolsheviks were gathering in many parts of the country.

Lenin insisted on ending the war with Germany at any price. He believed that such action was necessary if the Bolsheviks were to stay in power. On March 3, 1918, Russia and Germany signed the Treaty of Brest-Litovsk. The treaty required Russia to give up Finland, Poland, Bessarabia, Ukraine, Estonia, Livonia (now Latvia), and Lithuania. Germany agreed to allow the Russian government to continue ruling the rest of Russia. On March 12, Lenin moved Russia's capital from Petrograd to Moscow, partly so that his government would be farther from German power. The Treaty of Brest-Litovsk was a serious blow to Russia. But after Germany lost World War I in November 1918, the treaty became invalid.

In 1918, at Lenin's suggestion, the Bolsheviks changed the name of the Russian Social Democratic Labor Party to the Russian Communist Party (Bolsheviks).

Rule by terror. In December 1917, Lenin signed the decree that established the *Cheka,* a political police force, and set up rule by terror. Opponents of the Bolsheviks were imprisoned, murdered, or sent to the Gulag, a system of prison labor camps where many prisoners died. In July 1918, the Bolsheviks murdered Czar Nicholas II and his family. Lenin described his dictatorship as "power, based directly upon force, and unrestricted by any laws."

On Aug. 30, 1918, after speaking to the workers at a Moscow factory, Lenin was shot by Dora Kaplan, a member of the Social Revolutionary Party. Lenin was hit by two bullets but recovered in several weeks. Kaplan was executed. To discourage other attempts, the Bolsheviks executed hundreds of so-called "hostages."

Civil war. The revolution had spread quickly in the large cities of central Russia. But resistance in distant regions developed into civil war. In January 1918, Lenin formed the Red Army. It was named for the color of the flag of the world Communist movement. The forces opposing the Reds became known as the Whites. The Whites included revolutionaries, democrats, Russian nationalists, and those who preferred the old government and opposed any change. The Whites lacked unity of purpose and were unable to organize effectively. By 1920, the Bolsheviks had won the civil war.

The Russian economy had collapsed. Industrial output was at the vanishing point. Agricultural production had fallen disastrously. People in the cities were starving. Millions of Russians had died or had fled abroad. But the Communist government survived.

Even during the civil war, Lenin did not lose sight of his goal of Communist world revolution. In 1919, he had organized the Comintern to run Communist parties in all

Tass from Sovfoto



Lenin's tomb, *foreground,* attracted thousands of visitors to Red Square in Moscow each day before the Communists lost control of the Soviet government. The memorial contains a glass-covered casket that holds Lenin's embalmed body.

parts of the world. The organization also helped gain international support for the Bolsheviks during the civil war. In 1920, Lenin tried to export the revolution by military means by way of Poland to central Europe.

After the civil war, Lenin took extreme measures to keep control of his weakened country. In March 1921, he introduced the program called the New Economic Policy. This program replaced many of the socialist measures started at the beginning of his rule. Small businesses were permitted to resume limited operations. Free retail trade was allowed again. Foreign businesses were invited to invest in Russia. Peasants were allowed to sell food to private customers. Food supplies sent by the American Relief Administration saved hundreds of thousands of starving Russians.

Before 1921, Lenin had asked France, Germany, the United Kingdom, and the United States for credit, trade, and diplomatic recognition. But these nations were unwilling to deal with the Bolshevik government, which had refused to pay Russia's debts and favored a worldwide Communist revolution. By 1919, no major country maintained diplomatic relations with the Russian government. But after the New Economic Policy was begun, most European states resumed diplomatic relations.

Death. Lenin's health had been shattered by the strain of revolution and war. In May 1922, Lenin suffered a stroke. He worked on against his doctor's advice.

Lenin was concerned about the direction that the revolution was taking. He began to challenge some basic ideas of the Bolshevik government. Lenin opposed the concentration of power in government bureaus. He also feared Russian nationalism. Shortly before his stroke, he had appointed Joseph Stalin general secretary of the party. Now, Lenin had serious doubts about Stalin, who was reaching out for purely personal power.

In December 1922, the Bolshevik government established the Union of Soviet Socialist Republics (U.S.S.R.). That same month, Lenin suffered a second stroke. In January 1923, he warned that Stalin was "too rude" and lacked the talents necessary for party leadership. Lenin planned to remove Stalin as party secretary. On March 9, 1923, he had a third stroke and lost his power to speak clearly. His illness kept him from appointing a new party secretary. Stalin went on to rule the Soviet Union as a dictator from 1929 until 1953.

Lenin died of a brain hemorrhage on Jan. 21, 1924. The government preserved his body and placed it on display. Lenin's tomb, in Red Square, became one of the Soviet Union's most honored monuments. Thousands of visitors daily passed by the glass-enclosed coffin to view the founder of the Soviet Communist state. But in August 1991, the Communists lost control of the Soviet government. In December of that year, the Soviet Union broke up into a number of independent states. The fall of Communism unleashed proposals for removing Lenin's body from public display. The daily number of people visiting the tomb declined. Many people favored burying Lenin in St. Petersburg, next to his mother's grave. Lenin himself had requested this spot as his final resting place. Albert Marrin

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Additional resources

Haney, John. *Vladimir Ilich Lenin.* Chelsea Hse., 1988. Younger readers.
Service, Robert. *Lenin: A Political Life.* 3 vols. Ind. Univ. Pr., 1985-1995.

Leningrad. See Saint Petersburg.

Leningrad, Siege of, was a blockade of the city of Leningrad in the Soviet Union by German and Finnish troops during World War II (1939-1945). Leningrad is now St. Petersburg, Russia. The siege lasted 872 days from September 1941 to January 1944. Historians estimate that about 1.7 million Soviet people, including military personnel and civilians, may have died in and around Leningrad during the siege. But the enemy failed to capture the city. Leningrad's defense was a critical event in the war. Had the city fallen, the Germans could have exerted more pressure on the Soviet capital, Moscow, and possibly conquered it.

Germany attacked the Soviet Union in June 1941. The German dictator Adolf Hitler ordered the destruction of Leningrad, an important center for industry and weapons production. By September 8, the blockade was complete. Virtually the only connection that Leningrad maintained with the rest of the Soviet Union was across nearby Lake Ladoga, which German aircraft patrolled.

German artillery and aircraft bombarded Leningrad throughout the siege. The blockade produced severe shortages of fuel, food, and raw materials. During the winter and spring of 1941-1942, nearly 1 million Leningraders died from a combination of starvation and extreme cold. Bread was the only food that was regularly available, and the daily bread ration dropped as low as about $4\frac{1}{2}$ ounces (125 grams) for nonworkers and children. The temperature fell to −40 °F (−40 °C) in early 1942. Because of the frigid weather, however, Lake Ladoga froze, enabling the Soviets to build roads across the ice. Trucks delivered food to the city by means of the roads, and hundreds of thousands of starving Leningraders were evacuated over them.

In January 1943, the Soviet Red Army retook enough land along Lake Ladoga's southern coast to extend a rail line into the city. But the siege continued until Jan. 27, 1944, when German troops retreated before the advancing Red Army. Richard H. Bidlack

Lennon, John (1940-1980), was a founding member of the Beatles, a British band that became the most popular group in the history of rock music. Lennon and Paul McCartney wrote most of the Beatles' music. Lennon also played rhythm guitar and piano, and sang. Beatles songs written primarily by Lennon include "Help!" (1965), "All You Need



AP/Wide World

John Lennon

Is Love" (1967), and "A Day in the Life" (1967).

The Beatles disbanded in 1970, but Lennon continued to compose and perform, both as a solo artist and with Yoko Ono and the Plastic Ono Band. Ono married Lennon in 1969 and was his creative partner for the rest of his life. Lennon became known as one of rock's leading social critics through such songs of idealism as "Give Peace a Chance" (1969) and "Imagine" (1971).

John Winston Lennon was born in Liverpool, England, and moved to the United States in 1971. In 1980, Lennon and Ono released *Double Fantasy,* his first album in five years. On December 8 of that year, Lennon was shot to death outside his New York City apartment by a 25-year-old man named Mark David Chapman. Don McLeese

See also **Beatles.**

Lenoir, *luh NWAHR,* **Jean Joseph Étienne,** *zhahn zhoh ZEHF ay TYEHN* (1822-1900), a Belgian-born French inventor, built the first practical internal-combustion engine in 1860. This single-cylinder engine resembled a steam engine, but used street-lighting gas for fuel and had a storage-battery ignition system. Lenoir's engine started more quickly and easily than a steam engine and was more convenient to use. About 500 of the engines were sold. Lenoir used one of his one-horsepower engines to power a crude motor vehicle, and a two-horsepower engine to drive a boat. However, his engines used much fuel and lubricating oil, and the ignition system did not work well. Lenoir's engines soon became unpopular. He died in poverty. But his work encouraged others to develop internal-combustion engines. See also **Automobile** (The gasoline car); **Gasoline engine** (Development of the gasoline engine). Terry S. Reynolds

Le Nôtre, *luh NAW truh,* **André,** *ahn DRAY* (1613-1700), a French landscape designer, created many of the famous gardens of his day. He became known for the masterpieces he designed for King Louis XIV of France and the royal family. His most famous gardens were designed for the royal palace at Versailles. In France, he also designed gardens for the Château Vaux-le-Vicomte, and for parks in St.-Cloud, Fontainebleau, and Chantilly. In England, he created the gardens at Greenwich and influenced many other garden designs. Le Nôtre often used broad, treelined avenues to make his gardens appear expansive. He also arranged flower beds and shrubs in geometric patterns. He was born in Paris.
Albert J. Rutledge

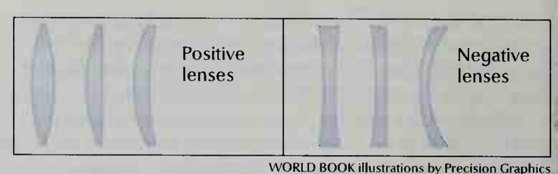
See also **Versailles, Palace of.**

Lens is a piece of transparent material that creates an image of an object by bending light. The image may be larger than, smaller than, or the same size as the object. The human eye has a lens that creates images on the *retina,* the innermost layer of the wall of the eyeball. Most manufactured lenses are made of glass or plastic. People use them in a variety of applications, including eyeglasses, cameras, microscopes, and telescopes.

Lens shapes

Scientists classify an individual lens as *positive* or *negative,* depending on the shape of its cross-section.

A positive lens is thicker at the center than the edge. The simplest positive lens manufactured is disk-shaped, and it bulges outward equally on both sides. The lens of the human eye has the same general shape, but the side that "faces the world" is slightly flatter than the back side.



WORLD BOOK illustrations by Precision Graphics

Positive lenses are thicker at the center than at the edge. **Negative lenses** are thicker at the edge than at the center.

Any lens that bulges outward on both sides, equally or not, is a *double-convex* lens. *Convex* means *curving out.*

Other positive lenses have one flat side and one side that bulges outward. Such lenses are commonly used in cameras, microscopes, and telescopes. They are less expensive to produce than double-convex lenses.

Some lenses in eyeglasses are also positive. Both sides of an eyeglass lens curve away from the eye, but one side curves more than the other. Lenses that are used to correct farsightedness are thicker at the center than at the edge, and are therefore positive. Contact lenses that correct farsightedness have the same shape.

A negative lens is thicker at the edges than in the center. The simplest kind of negative lens is disk-shaped, and it curves inward equally on both sides. Any lens that curves inward on both sides is a *double-concave* lens. *Concave* means *curving in.* Other negative lenses have one flat side and one side that curves inward. Eyeglass lenses and contact lenses that are used to correct nearsightedness are thicker at the edges than at the center and are therefore negative lenses.

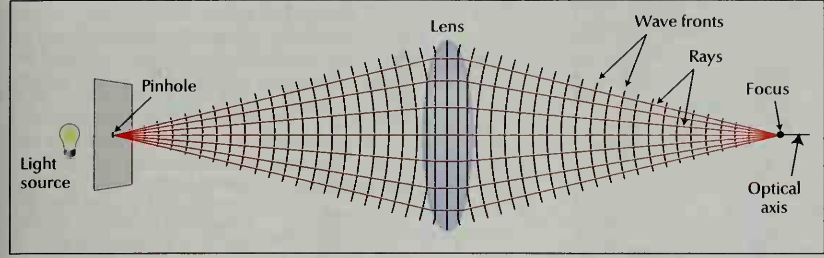
Creating an image

A lens creates an image by bending light in a process known as *refraction.* Light travels in waves, which consist of alternating crests and troughs. The crest of an individual wave travels as a *wave front* that is perpendicular to the wave's direction of motion. This movement is similar to that of an ocean wave approaching a beach. You can also think of light as traveling in rays along the wave's direction of travel. At the beach, a surfer riding a wave directly toward shore would represent a ray.

To understand how refraction occurs, imagine that you are holding a glass lens vertically, with its edge resting on a desktop. One side of the lens is facing left, and the other side is facing right. To the left of the lens is a burning candle mounted in a transparent holder. The bottom of the candle lies across the lens's *optical axis,* a horizontal line passing through the center of the lens.

Consider a wave front originating at the point on the candle that is on the optical axis and facing the lens. The wave front will *diverge* (expand) from this point in all directions, except where it is blocked by the candle. Thus, the wave front will resemble an expanding spherical shell. Part of the wave front that travels to the right will strike the lens and enter it. As the wave front enters the lens, the lens will refract it, because light travels more slowly through glass than through air.

A real image. Suppose the lens is positive—thicker at the center than the edge. The part of the wave front that travels across the lens's center will travel farther through glass than will the part traveling across the edge. The center part of the wave front will therefore travel at the



WORLD BOOK illustration by Precision Graphics

Light rays spread out from a pinhole, then bend as they enter and leave a positive lens. All the light comes together at the *focus.* If the pinhole is on the lens's *optical axis,* a line through its center, the focus will also be on the optical axis.

reduced speed for a longer time than will the part at the edge. As a result, the light coming through thinner portions of the lens will catch up with, and eventually overtake, the light moving through the center. Due to this activity, the light rays will bend at the surfaces of the lens.

Convergence. If the candle is far enough from the lens, the wave front will *converge* (become narrower and narrower) on the right side of the lens. Eventually, it will come together at a point called the *focus* on the optical axis. The light will then pass through the focus, fanning out as it continues to travel to the right.

A wave front originating at the tip of the flame will also pass through the lens and converge to a point. But because the flame tip is above the optical axis, this point of convergence will be below the optical axis. Similarly, a wave front from every other point on the side of the candle facing the lens will travel through the lens. Each of these wave fronts will also converge to a point on the opposite side of the axis from its point of origin.

The focal plane. All the points of convergence will occur in, or close to, an imaginary flat surface known as the *focal plane.* This surface will be perpendicular to the optical axis. If a motion-picture screen is placed in the focal plane, an image of the candle will become visible on the screen. The image will be *inverted*—that is, it will be upside down and backward. An image created in this way is known as a *real image.*

The focal length. The location of the focal plane and the size of the image will depend on the distance from the object to the lens and on the *power* of the lens. The power of a lens is defined in terms of its *focal length;* the more powerful the lens, the shorter its focal length. A lens's focal length is approximately equal to the distance from the center of the lens to a point known as the *focal point* of the lens. This is the point of convergence of an incoming wave front that is perpendicular to the optical axis and is neither diverging nor converging when it enters the lens. That is, the incoming light rays are parallel.

The lens equation. The distance from a positive lens to an object to its left (D_o), the distance from the lens to the corresponding image to its right (D_i), and the lens's focal length *(F)* are related according to the following equation, which is known as the *lens equation:*

$$\frac{1}{D_o} + \frac{1}{D_i} = \frac{1}{F}$$

If you know two of the factors, you can use the equation to find the third. Suppose the candle is 150 millimeters from the lens, and the focal length of the lens is 50 millimeters. How far is the image from the lens?

$$\frac{1}{150} + \frac{1}{D_i} = \frac{1}{50}$$

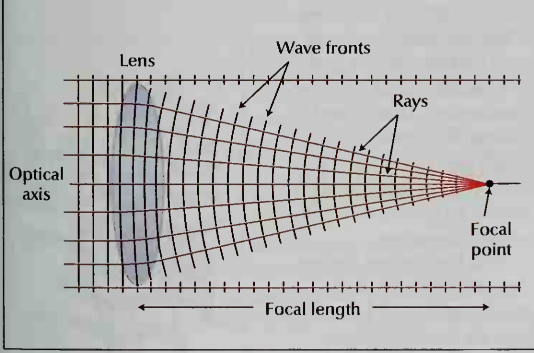
$$\frac{1}{D_i} = \frac{1}{50} - \frac{1}{150} = \frac{3}{150} - \frac{1}{150} = \frac{1}{75}$$

$$D_i = 75 \text{ millimeters}$$

To determine the size of the image relative to the length of the object, divide D_o by D_i. In our example, the image is two-thirds as long as the candle.

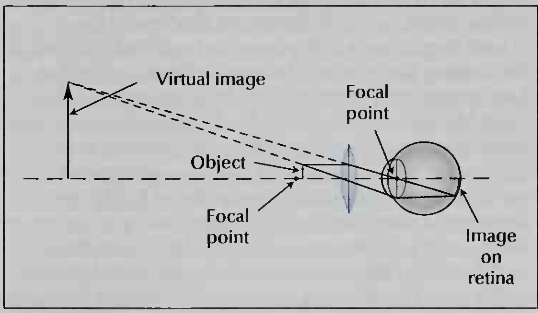
A virtual image. If the distance from the candle to the lens is equal to the focal length, the lens equation will give you an answer of infinity for D_i. This result indicates that a wave front emerging from the lens will not change in width as it travels to the right. Because there will be no convergence, no image can form on a screen, no matter how far the screen is moved to the right.

If the distance from the candle to the lens is less than



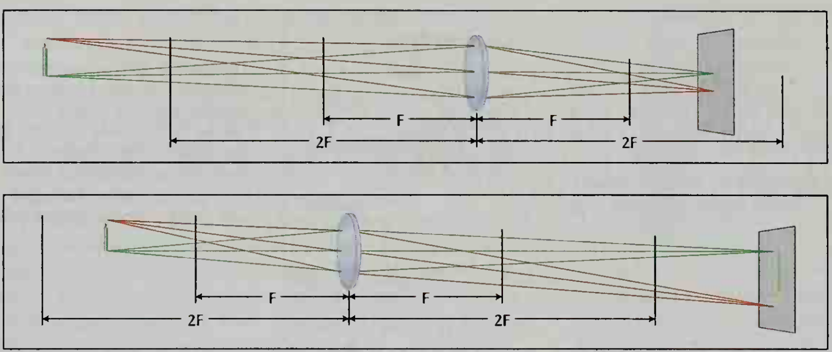
WORLD BOOK illustration by Precision Graphics

Focal length determines a lens's power: the shorter the length, the greater the power. A lens's focal length is approximately the distance from its center to its *focal point.* This point is the focus of wave fronts that approach the lens as from the left in this diagram—perpendicular to the *optical axis,* a line through its center.



WORLD BOOK illustration by Precision Graphics

The eye helps create an image of an object that is closer to a positive artificial lens than the focal point on the other side of that lens. The eye's lens bends light rays, creating an image on the retina. We see a *virtual image* that is larger than the object, so an artificial lens used in this way is called a *magnifying glass.*



A positive lens produces an image that can be viewed on a screen if the object is more than one focal length (F) from the lens. Such an image, known as a *real image,* is *inverted* (upside down). If the object is more than two focal lengths (2F) from the lens, the image will be smaller than the object. If the object is between F and 2F, the image will be larger than the object.

WORLD BOOK illustrations by Precision Graphics

the focal length, the equation will give a negative answer for D_i. A wave front emerging from the lens will continue to diverge. No image can form on a screen.

Viewed through a positive lens. You can, however, use wave fronts that diverge from a positive lens to create an image. One way to do this is to look through the lens in the direction of the object. The lens of your eye will cause the fronts to converge. You will see an image that is larger than the object and is not inverted. An image created in this way is known as a *virtual image.* A positive lens used in this way is a *magnifying glass.*

Viewed through a negative lens. Suppose the lens in our example is negative. The center part of the wave front will spend less time in glass, and so it will come out of the lens ahead of the remainder of the wave front. The diverging rays entering the lens will therefore diverge more as they leave. As with a magnifying glass, you can create a virtual image by looking through a negative lens. The image will not be inverted, and it will be smaller than the object. W. Thomas Roberts, Jr.

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Contact lens	Microscope	

Lent is a religious season observed in the spring by most Christians. It serves as a time of spiritual discipline and renewal in preparation for Easter. Many churches hold special worship services during the season. In addition, Christians observe Lent with fasting, prayer, and self-sacrifice. Some Christians do charity work.

Lent begins on Ash Wednesday in many churches. In the Eastern Catholic and Eastern Orthodox churches, Lent begins on a Monday, which is sometimes called *Pure Monday* or *Clean Monday.* The Lenten season lasts about 40 days, excluding Sundays in Western churches, and excluding Saturdays and Sundays in Eastern churches. The number 40 recalls Jesus's 40-day fast in the wilderness, as described in the Gospels. Most churches reserve special observance of Jesus's *Passion* (suffering and death) for the last week of Lent, called Holy Week.

The word *Lent* comes from words meaning *long* and *spring* and probably refers to the lengthening of days as spring approaches. Lent probably grew out of the early Christian church's practice of baptizing people at the Easter *vigil* (watch), a service held on Easter eve. During the vigil, the church also accepted repentant Christians back into the faith. In the weeks before Easter, baptism candidates received religious instruction and fasted. By the A.D. 900's, Lent had become a time of penance and Easter preparation for all Christians. Observance of Lent was set at 40 days in the A.D. 600's. David G. Truemper

See also **Ash Wednesday; Easter; Holy Week; Palm Sunday.**

Lenticel, *LEHN tuh SEHL,* is a round or long swelling on the bark of woody stems and roots that functions as a breathing pore. Lenticels are formed when growth areas develop beneath the *cork* (outer layers of the bark). Each growth area produces a mass of new growing cells. As these cells enlarge, they press against and finally break the outer layer of the bark to form a lenticel. The cells of the lenticel are separated by spaces through which air reaches the inner parts of the stem. The rounded marks on horse chestnut stems and the long marks on cherry bark are lenticels. See also **Bark.** James D. Mauseth

Lentil, *LEHN tuhl,* is an ancient food plant. It belongs to the leguminous family of plants, and grows in Egypt, southern Europe, the United States, and western Asia. Its long fruits, or pods, look like those of the pea and bean. The seeds of the lentil are the part used as food. They are red-brown, gray, or black, and never grow more than $\frac{1}{2}$ inch (13 millimeters) in diameter. The lentil seeds are shaped like a lens. The lens itself was so named because it looked like a lentil seed.

Lentil seeds have a distinct flavor and are among the most nutritious legumes. They are rich in protein and carbohydrates and are usually used to make casseroles, salads, and soups. As a table food, lentil seeds are not as common in the United States as they are in many other countries.



WORLD BOOK illustration by Kate Lloyd-Jones, Linden Artists Ltd.

Lentil

The lentil plant grows best in light, dry soil. Plants grown in too rich a soil do not bear many pods. The plant is used as fodder for sheep, horses, and cattle. The lentil, one of the first cultivated food plants, was first grown

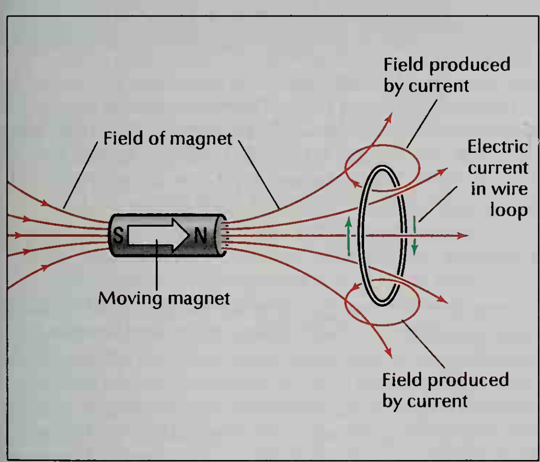
about 2200 B.C. According to Genesis 25:34, Esau sold his birthright for a "pottage of lentils." S. J. Locascio

Scientific classification. The lentil is in the pea family, Fabaceae or Leguminosae. Its scientific name is *Lens culinaris.*

Lenz's law, *LEHN zuhz* or *LEHNT suhz,* is a principle that relates magnetism to electric current, describing the direction of a current produced by a changing magnetic field. A *magnetic field* is the influence that a magnet or electric current creates in the region around it. A changing magnetic field creates a current in a conductor, such as a coil of wire, by a process called *electromagnetic induction.*

When a changing magnetic field creates a current, the current, in turn, creates its own magnetic field. Lenz's law states that the current flows in such a direction that its magnetic field opposes the change in the original magnetic field. Thus, whatever device is changing the original magnetic field must do work to keep the current flowing. Lenz's law is named for the Russian physicist Heinrich F. E. Lenz, who discovered the principle in 1833.

Lenz's law explains why energy must be supplied to turn the generators that provide our electric power. An electric generator consists of wire coils that spin in a magnetic field. As the coils spin, the field changes relative to the coils, and so a current flows in them. But the field created by the current opposes the changing magnetic field and therefore opposes the spinning of the coils. Thus, unless energy is supplied to the generator, it will quickly come to a stop. Richard Wolfson



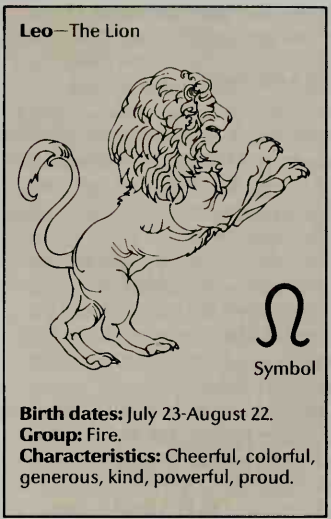
WORLD BOOK diagram by Precision Graphics

The changing magnetic field of a moving magnet produces a current in a wire loop. Lenz's law states that this current's direction is such that the field it creates opposes the change.

Leo, a constellation. See **Astronomy** (map: The stars and constellations of the Northern Hemisphere).

Leo is the fifth sign of the zodiac. It is symbolized by a lion. Astrologers believe that Leo is ruled by the sun. Leo is a fire sign.

Astrologers regard people born under the sign of Leo, from July 23 to August 22, as energetic, generous, and strong-willed. The lion and the sun are traditionally linked with kings, and Leos have kingly qualities. They are good leaders and enjoy being the center of attention



Signs of the Zodiac
Aries
Mar. 21-Apr. 19
Taurus
Apr. 20-May 20
Gemini
May 21-June 20
Cancer
June 21-July 22
Leo
July 23-Aug. 22
Virgo
Aug. 23-Sept. 22
Libra
Sept. 23-Oct. 22
Scorpio
Oct. 23-Nov. 21
Sagittarius
Nov. 22-Dec. 21
Capricorn
Dec. 22-Jan. 19
Aquarius
Jan. 20-Feb. 18
Pisces
Feb. 19-Mar. 20

WORLD BOOK illustration by Robert Keys

and importance. But Leos can sometimes be too proud.

Leos like colorful, showy things. They are attracted to occupations in such fields as the jewelry business and the theater. Christopher McIntosh

See also **Astrology; Horoscope; Zodiac.**

Leo I, Saint (400?-461), was elected pope in 440. He was also called *the Great.* Leo is most famous for defending orthodox church theology and for defining papal authority.

Leo was probably born in Tuscany in northern Italy. He exercised more day-to-day power than any previous pope. He devoted much of his reign to extending his control and authority over the bishops of Italy, Gaul, Spain, and North Africa. Leo worked out the *Petrine theory* of papal *primacy* (supreme authority). This theory states that Jesus named Saint Peter as the leader among the original apostles (Matthew 16:17-19). The theory claimed that Peter's successors, the bishops of Rome, inherited Peter's authority. See **Pope** (The early papacy).

Through Leo's work at the Council of Chalcedon in 451, basic doctrines were proclaimed about Jesus Christ, especially about His divine and human natures. These doctrines remain in force in most Christian churches today. Leo gained much respect during his reign for persuading Attila, king of the Huns, not to attack Rome in 452. Leo also worked out an agreement with Genseric, leader of the Vandal tribe, that limited the destructiveness of a Vandal attack on Rome in 455.

Leo was a gifted and forceful writer, leaving 123 authentic letters and 96 sermons. He was not an original thinker, but he had a great ability to organize and explain the thought of previous popes. Thomas F. X. Noble

Leo III, Saint (?-816), was elected pope in 795. His methods and personality antagonized the aristocratic Romans who held many offices in the papal government, and they organized numerous plots and rebellions against him. In 799, a gang brutally attacked Leo on a Roman street and he fled Rome to seek protection from his friend and ally, Charlemagne, king of the Franks. In November 800, Charlemagne himself went to Rome to investigate Leo's problems. However, by then no one would publicly accuse the pope of wrongdoing,

though previously charges of *simony* (selling of church offices) and immorality had been made against him. Leo took an oath of innocence and Charlemagne reaffirmed his support. On Christmas Day, 800, Leo crowned Charlemagne emperor of the Romans.

Leo was born in southern Italy. As pope, he was active in church affairs in England and Bavaria and strongly defended the faith against heresy. Leo built and restored many churches in and around Rome. Thomas F. X. Noble

Leo IX, Saint (1002-1054), was elected pope in 1049. The most significant event of his reign was the diplomatic mission he sent to Constantinople in 1054. His *legate* (representative) excommunicated the patriarch of Constantinople, which marked the beginning of the *schism* (split) between the Western and Eastern churches. See **Eastern Orthodox Churches** (History).

Leo was a vigorous reformer. Shortly after his election, he summoned a *synod* (council) that outlawed *simony,* the buying of religious offices. Simony had been one of the chief abuses within the church. This was the first of a series of reforming synods Leo held in Italy, France, and Germany. He issued decrees against simony, clerical marriage, and many other church problems. His actions increased the prestige of the papacy.

Leo was born in Egisheim, now in France, near Colmar. He was called Bruno of Egisheim before becoming pope. His feast day is April 19. Kenneth Pennington

Leo X (1475-1521), was pope during the climax of the Renaissance in Rome, but he also faced the beginnings of the Protestant Reformation. Leo was elected pope in 1513. He was a pleasure-loving man and a patron of the arts. He spent lavishly on papal court spectacles and on patronage for scholars, composers, and artists.

Leo was born in Florence, Italy. His given and family name was Giovanni de' Medici. His father was the powerful Florentine leader Lorenzo de' Medici. During Leo's reign, France and Spain engaged in a long conflict for dominance of Italy. Leo tried to preserve papal *temporal* (nonreligious) power, maintain the independence of Florence, and advance his family's interests. The Reformation began in 1517. But Leo was preoccupied with the cultural life of Rome, Italian politics, growing Ottoman power in the Mediterranean, and the election of a Holy Roman emperor in Germany. He was slow to grasp the seriousness of the Protestant challenge. His condemnation of Protestant leader Martin Luther in 1520 was too late to be effective, and the Protestant split from Rome became permanent. Charles L. Stinger

Leo XIII (1810-1903), was elected pope in 1878. His reign was the second longest in papal history. Only Pius IX served longer. Leo wrote many *encyclicals*—that is, letters to the entire Roman Catholic Church. One of the most famous was *Rerum Novarum* (1891), which upheld the rights of labor.

Leo was open to new forms of government but was suspicious of democracy. In a letter to United States Catholics in 1895, he warned against seeing the American separation of church and state as an ideal for all nations. In 1899, he addressed another letter to the American church condemning *Americanism,* a movement that had many followers in France and Italy. It was an adaptation of such American concepts as religious liberty and the need to adjust the presentation of Catholic teachings to modern ideas and practices. Leo was born in Carpineto, Italy, near Rome. His given and family name was Gioacchino Vincenzo Pecci. Gerald P. Fogarty

See also **Roman Catholic Church** (Leo XIII).

León, *lay OHN* (pop. 161,530), is the chief intellectual center and an important farm produce market in Nicaragua. The city is located in a western farming district, about 50 miles (80 kilometers) northwest of Managua (see **Nicaragua** [map]).

León is the home of the National University of Nicaragua, as well as a national institute and two religious colleges. The city's many fine buildings include the largest cathedral in Central America.

Spanish explorers founded León in 1525 on the shores of Lake Managua. It was moved to its present location in 1610 after the old town was destroyed by an earthquake. León served as the provincial capital of Nicaragua for many years, and then as the capital of the republic until 1855. Gary S. Elbow

León, Alonso de. See **Texas** (French exploration).

León, Ponce de. See **Ponce de León, Juan.**

Leonard, Elmore (1925-), is an American author best known for his crime novels. Leonard's books are not mystery stories. Instead, they are realistic novels about police officers, small-time criminals, and ordinary people drawn into dangerous situations. He heightens the realism of his fiction with background research. Leonard creates believable characters who tell their own stories. His books contain colorful dialogue.

Elmore John Leonard, Jr., was born in New Orleans and raised in Detroit, the setting for several of his novels. He was an advertising copywriter from 1950 to 1961 and left the advertising field entirely in 1966 to write full-time. He began to write Western fiction in the early 1950's, writing each morning before going to work. His most notable Western novel was *Hombre* (1961).

Leonard published his first crime novel, *The Big Bounce,* in 1969. His other novels include *Fifty-Two Pickup* (1974), *The Hunted* (1977), *Stick* (1983), *Glitz* (1985), *Bandits* (1987), *Freaky Deaky* (1988), *Get Shorty* (1990), *Rum Punch* (1992), *Pronto* (1993), and *Riding the Rap* (1995). He has also written screenplays. David Geherin

Leonard, Sugar Ray (1956-), an American boxer, won world professional boxing titles in five weight classes. Leonard won the World Boxing Council (WBC) welterweight title in 1979, defeating Wilfred Benitez. He won the World Boxing Association (WBA) junior middleweight title with a victory over Ayub Kalule in 1981. Leonard retired from boxing after eye surgery in 1982, but he made a comeback and defeated Marvin Hagler for the WBC middleweight title in 1987. Leonard won both the WBC super middleweight and light heavyweight titles in 1988 by defeating Donny Lalonde. In 1991, Leonard again announced his retirement as a boxer. However, he returned to boxing in 1997, losing to Hector Camacho. Leonard then said his retirement was final. He had a career professional record of 36 victories, 3 defeats, and 1 draw.

Ray Charles Leonard was born in Wilmington, North Carolina. He was nicknamed "Sugar" after former boxing champion Sugar Ray Robinson. He first achieved prominence by winning the gold medal in the light welterweight class at the 1976 Olympic Summer Games in Montreal. Dave Nightingale

See also **Boxing** (picture: Modern boxing champions).



Oil painting on wood (1503); The Louvre, Paris (Giraudon/Art Resource)

Leonardo da Vinci's Mona Lisa is probably the most famous portrait ever painted. Its blurred outlines, graceful figure, dramatic contrasts of dark and light, and overall feeling of calm are characteristic of Leonardo's style.

Leonardo da Vinci

Leonardo da Vinci, *lee uh NAHR doh duh VIHN chee* or *lay uh NAHR doh duh VIHN chee* (1452-1519), was one of the greatest painters and most versatile geniuses in history. He was one of the key figures of the Renaissance, a great cultural movement that had begun in Italy in the 1300's. His portrait *Mona Lisa* and his religious scene *The Last Supper* rank among the most famous pictures ever painted.

Leonardo, as he is almost always called, was trained to be a painter. But his interests and achievements spread into an astonishing variety of fields that are now considered scientific specialties. Leonardo studied anatomy, astronomy, botany, geology, geometry, and optics, and he designed machines and drew plans for hundreds of inventions.

Because Leonardo excelled in such an amazing number of areas of human knowledge, he is often called a universal genius. However, he had little interest in literature, history, or religion. He formulated a few scientific laws, but he never developed his ideas systematically. Leonardo was most of all an excellent observer. He concerned himself with what the eye could see, rather than with purely abstract concepts.

Leonardo's life

Early career. Leonardo was probably born outside the village of Vinci, near Florence in central Italy. The name *da Vinci* simply means *from Vinci.* At that time, Florence and its surrounding villages and farms made up a nearly independent area called a *city-state.* Florence was also a commercial and cultural center. Leonardo was the illegitimate son of Ser Piero da Vinci, a legal specialist, and a peasant woman named Caterina. Ser Piero's family raised the boy in Vinci.

During the late 1460's, Leonardo became an apprentice to Andrea del Verrocchio, a leading painter and sculptor in Florence. He remained with Verrocchio as an assistant for several years after completing his apprenticeship. Verrocchio and Leonardo collaborated on the painting *The Baptism of Christ* about 1472.

From about 1478 to 1482, Leonardo had his own studio in Florence. During this period, he received an important commission to paint a church altarpiece now known as the *Adoration of the Kings.*

Years in Milan. Leonardo never finished the *Adoration of the Kings* because he left Florence about 1482 to become court artist for Ludovico Sforza, the Duke of Milan. Leonardo lived in Milan until 1499. He had a variety of duties in the duke's court. As a military engineer, he designed artillery and fortresses. As a civil engineer, he devised a system of locks for Milan's canals and designed revolving stages for pageants. As a sculptor, he planned a huge monument of the duke's father mounted on a horse.

About 1483, Leonardo painted the *Madonna of the Rocks.* This painting is his earliest major work that survives in complete form. During his years in Milan, he also created his famous wallpainting *The Last Supper.*

Return to Florence. In 1499, the French overthrew Ludovico Sforza and forced him to flee Milan. Leonardo also left the city. He visited Mantua, where he made a famous drawing of Isabella d'Este, the wife of the Duke of Mantua. He also visited Venice briefly before returning to Florence.

Leonardo's paintings during his stay in Milan had made him famous, and the people of Florence received him with great respect. The early work Leonardo had done in Florence before he left for Milan had strongly influenced a number of young artists, including Sandro Botticelli and Piero di Cosimo. These artists had become the leaders of the next generation of Florentine painters. The work Leonardo was to create after his return to Florence would inspire yet another generation of artists. This generation included Andrea del Sarto, Michelangelo, and Raphael.

When Leonardo returned, Florence was building a new hall for the city council. The Florentine government hired Leonardo and Michelangelo to decorate the walls of the hall with scenes of the city's military victories. Leonardo chose the Battle of Anghiari, in which Florence had defeated Milan in 1440. His painting showed a cavalry battle, with tense soldiers, leaping horses, and clouds of dust.

In painting the *Battle of Anghiari,* Leonardo tried an experimental technique that did not work. The paint be-



Unfinished oil painting on wood (early 1500's); The Louvre, Paris (Erich Lessing for Art Resource)

The Virgin and Child with Saint Anne is arranged in a pyramid shape. Leonardo often used this arrangement.



Oil on panel (about 1486); Cartorysky Museum, Cracow, Poland (SCALA/Art Resource)

Portraits by Leonardo include *Lady with an Ermine* (1483-1486), *above,* and *Ginevra de'Benci* (about 1474), *below.* The calm expression of both subjects is typical of the artist's portraits.

Oil on panel (ca. 1474); National Gallery of Art, Washington D.C., Ailsa Mellon Bruce Fund



gan to run, and he never finished the project. The painting no longer exists. Its general appearance is known from Leonardo's sketches and from copies made by other artists. About 1503, while working on the *Battle of Anghiari,* Leonardo painted the *Mona Lisa,* probably the most famous portrait ever painted.

Last years. In 1513, Pope Leo X gave Leonardo rooms for his use in the Vatican Palace. Leonardo did little painting during his later years. However, about 1515, he completed *The Deluge,* a series of drawings in which he portrayed the destruction of the world in a tremendous flood. These drawings are the climax of Leonardo's attempts to visualize the forces of life and nature.

Renaissance rulers competed to surround themselves with great artists and scholars. In 1516, Francis I, the king of France, invited Leonardo to become "first painter and engineer and architect of the king." He provided Leonardo a residence connected to the Palace of Cloux at Amboise, near Tours. Leonardo devoted his time to doing anatomical drawings, drafting architectural plans, and designing sets for court entertainments. He died on May 2, 1519.

Leonardo's works

Drawings and scientific studies. Leonardo used drawings both as a tool of scientific investigation and as



Adoration of the Kings, intended as an altarpiece, was left unfinished after Leonardo worked on it in 1481 and 1482. The artist drew the scene in pen and ink. He used a technique called *metal point* to add precise details with a metal rod much like a pencil. He also brushed on a fine layer of color called a *wash* to give the scene shading and volume.

Uffizi Gallery, Florence, Italy (SCALA/Art Resource)

an expression of artistic imagination. He changed forever the art of drawing. He made drawings in much greater numbers than any artist before him, and he was one of the first artists to use sketches to work out his artistic and architectural compositions. Drawing was indispensable to Leonardo's processes of observation, creation, and invention.

Physical sciences. Leonardo was interested in *mechanics* (the science of motion and force), and many of his ideas and designs were far ahead of their time. For example, he drew plans for aircraft, including a helicopter, and for a parachute. Like many Renaissance artists, Leonardo sometimes worked as an engineer or military architect. He produced designs for a variety of war machines, among them tanks, machine guns, and movable bridges.

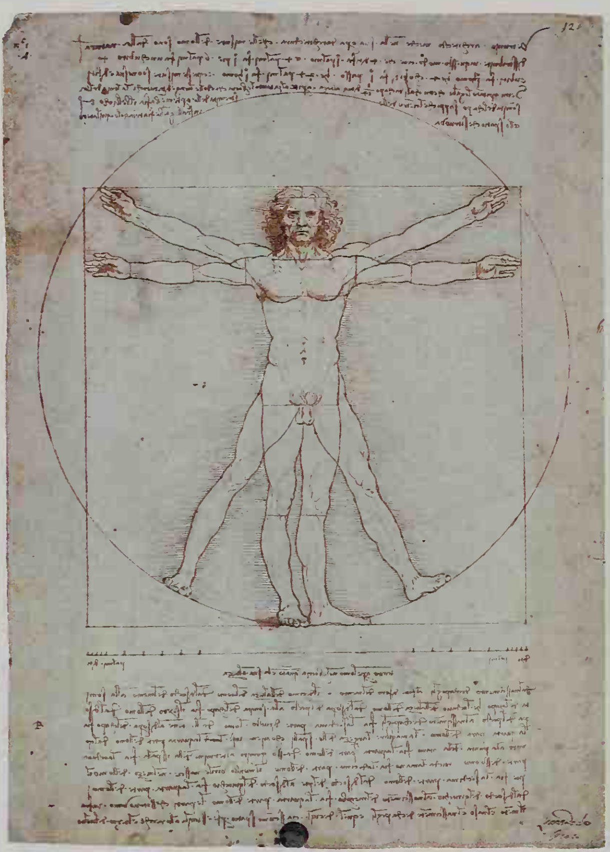
Life sciences. Leonardo studied anatomy by dissecting human corpses and the bodies of animals. He made scientific drawings that clarify not only the appearance of bones, tendons, and other body parts, but also their function. These drawings are considered the first accurate portrayals of human anatomy.

Leonardo tried to understand the human body as a mechanism. As his studies progressed, he also tried to understand the forces of life that animated the body. His drawings of anatomy, for example, extended to investigations of human reproduction and embryology and the circulation of the blood. None of these things were understood at the time. His anatomical drawing of a female, which he made about 1508, is his attempt, partly erroneous in detail, to illustrate the body's circulatory and other systems in a single image.

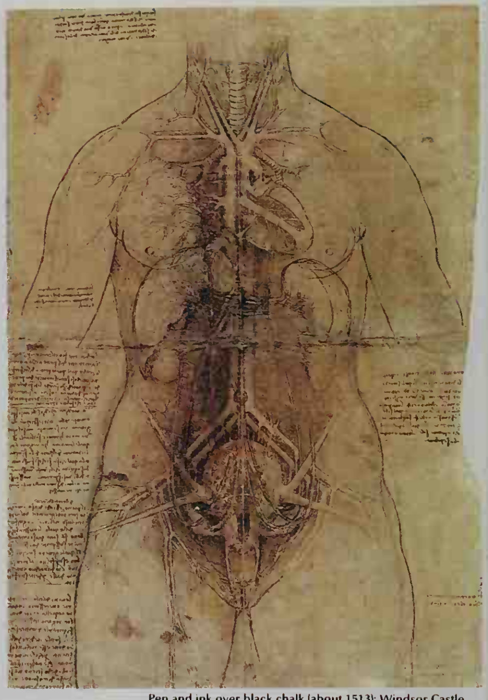
Like other artists, Leonardo was interested in the proportions of the human body. He drew a famous study of human proportions based on the statement of the Roman architect Vitruvius that the "well-shaped man" fits into the perfect shapes of the square and circle. According to Vitruvius, the parts of the body are related to one another in ratios of whole numbers, and these ratios should be used in the design of architecture. Leonardo's drawing of the *Vitruvian man,* done about 1487, is one of the most famous images in European art.

Leonardo also worked to understand the relation between the life of the human body and that of the larger world. For Leonardo, principles of proportion similar to those that shaped the human body also governed the growth of trees, the flight of birds, and the flow of water. When Leonardo drew the leaves of a plant, he intended the lines to show living energy responding to light, water, and soil. The mystery of life was the unifying theme of his work.

Leonardo's notebooks. Leonardo planned to write books on many subjects, including painting, human movement, and the flight of birds, but he never completed any of them. The writings exist in partial drafts and fragments in notebooks. Leonardo's notebooks also include his scientific observations and ideas for inventions, as well as detailed drawings. Most of the note-



Pen and ink (about 1492); Accademia, Venice, Italy (SCALA/Art Resource)



Pen and ink over black chalk (about 1513); Windsor Castle (The Royal Collection © Her Majesty Queen Elizabeth II)

Leonardo's scientific drawings include his famous study of human proportions called *Vitruvian man, left,* and an anatomical drawing of a female, *above,* in which Leonardo illustrated the body's circulatory and other systems. Leonardo produced more drawings than any artist before him.

books were not published until nearly 400 years after Leonardo's death. By the time his scientific and technical investigations became widely known, other people had come up with the same ideas.

Paintings. For much of his life, Leonardo was interested in optics, which is concerned with the properties of light. Leonardo carefully analyzed such things as the pattern of light and shadow on a sphere before a window. The understanding he gained from such study is evident in the rich effects of light, dark, and color in such paintings as the *Mona Lisa* and *The Virgin and Child with Saint Anne* (early 1500's).

Leonardo also explored the techniques of perspective, which painters use to create an illusion of depth on a flat surface. Florentine artists began to use these techniques in the early 1400's. *Linear perspective* is based on the optical illusion that parallel lines seem to converge as they recede toward one point, called a *vanishing point. Aerial perspective* is based on the fact that light, shade, and color change with an object's distance from the viewer.

Early paintings. Verrocchio and Leonardo shared the work of painting *The Baptism of Christ,* which is reproduced in the *World Book* article **John the Baptist, Saint.** Leonardo painted the left angel, the distant landscape, and possibly the skin of Christ. Leonardo's parts of the painting, with their soft shadings and shadows concealing the edges, are an early example of the *sfumato* (smoky) quality of his paintings. Verrocchio's figures, on the other hand, are defined by hard lines typical of early Renaissance painting. Leonardo's more graceful approach marked the beginning of the High Renaissance style, which did not become popular in Italy until about 25 years later.

Leonardo's *Adoration of the Kings* exists today in an unfinished form, with the figures visible only as outlines of contrasting light and dark areas. This kind of composition is called *chiaroscuro,* a word which combines the Italian words for *light* and *dark.* Chiaroscuro is characteristic of the High Renaissance style.

The *Adoration of the Kings* shows three kings worshiping the newborn Christ child. Leonardo abandoned the traditional treatment of this popular subject. Earlier versions showed the figures in profile, with the Virgin Mary and Jesus on one side of the painting and the kings on the other. To give the Holy Family more emphasis, Leonardo placed them in the center, facing the viewer. The kings and other figures form a semicircle around Mary and Jesus. Leonardo sharply contrasted foreground and background. Strong light-dark contrasts and simple geometric forms were basic features of Leonardo's mature style as a painter.

In the *Adoration of the Kings,* Mary and the Christ child are arranged in a pyramid shape. Leonardo also used this arrangement in other paintings, including the *Madonna of the Rocks* and *The Virgin and Child with Saint Anne.* The *Madonna of the Rocks* is reproduced in the **Painting** article. In *The Virgin and Child with Saint*

Anne, pictured with this article, the gazes of all the figures are concentrated on one side of the pyramid, giving it a new psychological and dramatic unity.

The Last Supper. Leonardo finished painting *The Last Supper* about 1497. He created the famous scene on a wall of the dining hall in the monastery of Santa Maria delle Grazie. The painting shows the final meal of Jesus Christ and His 12 apostles. Jesus has just announced that one of them will betray him. *The Last Supper* is reproduced in the article on **Jesus Christ.**

When painting *The Last Supper,* Leonardo rejected the *fresco* technique normally used for wallpaintings. The technique requires an artist to mix dry pigments with water and brush them onto damp, freshly laid plaster. An artist who uses the fresco method must work quickly. But Leonardo wanted to paint slowly, to revise his work, and to use shadows—all of which would have been impossible in fresco painting. He developed a new technique that involved coating the wall with a compound he had created. But the compound, which was supposed to hold the paint in place and protect it from moisture, did not work. Soon after Leonardo completed the picture, the paint began to flake away. *The Last Supper* still exists, but in poor condition, though many attempts have been made to restore it.

Leonardo also changed the traditional arrangement of the figures. Christ and His apostles are usually shown in a line, with Judas, the betrayer, set apart in some way. Leonardo painted the apostles in several small groups. Each apostle responds in a different way to Christ's announcement that one of them will betray Him. Jesus sits in the center of the scene, apart from the other figures. Leonardo's composition creates a more active and centralized design than earlier artists had achieved. The composition, in which the space recedes to a point behind the head of Christ, is one of the great examples of one-point perspective in Italian Renaissance painting. Leonardo used linear perspective to focus attention on the painting's religious and dramatic center, the face of Jesus Christ.

Mona Lisa, shown in this article, is probably a portrait of the young wife of a rich Florentine silk merchant, Francesco del Giocondo. *Mona Lisa* is a shortened form of *Madonna Lisa* (my lady, Lisa). The woman is also often called *La Gioconda,* which is the feminine form of her husband's last name.

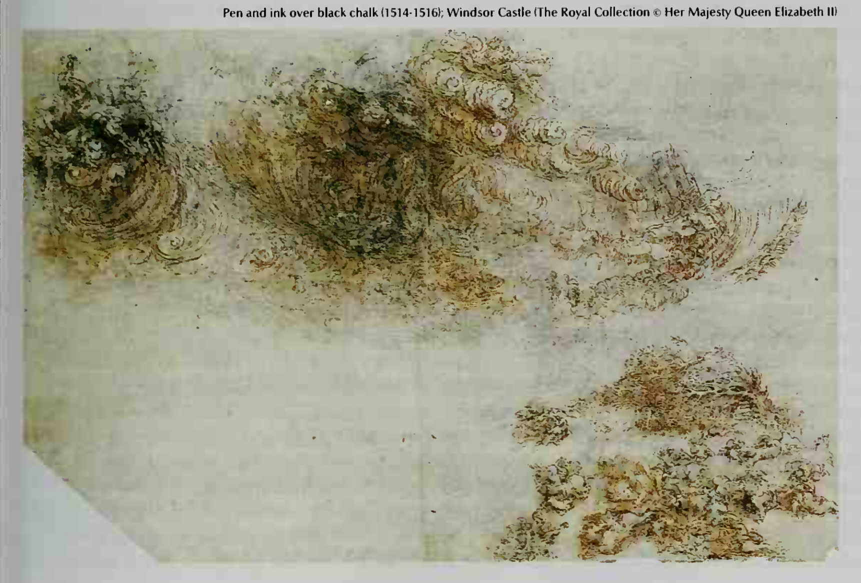
The portrait shows a young woman seated on a balcony high above a landscape. Leonardo used a pyramid design to place the woman simply and calmly in the space of the painting. Her folded hands form the front corner of the pyramid. Her breast, neck, and face glow in the same light that softly models her hands. The light gives the variety of living surfaces to an underlying geometry of spheres and circles, which includes the arc of her famous smile. Behind the figure, a vast landscape recedes to icy mountains. Winding paths and a distant bridge give only the slightest indications of human presence. The landscape reflects Leonardo's studies of geology. He was one of the first people to grasp that geological time is revealed in rock layers and to understand such processes as erosion.

Leonardo's importance

Leonardo had one of the greatest scientific minds of the Italian Renaissance. He wanted to know the workings of what he saw in nature. Many of his inventions and scientific ideas were centuries ahead of his time. For example, he was the first person to study the flight of birds scientifically. Leonardo's importance to art was even greater than his importance to science. He had a strong influence on many leading artists, including Raphael and Michelangelo. Leonardo's balanced compositions and idealized figures became standard features of later Renaissance art. Painters also tried to imitate Leonardo's knowledge of perspective and anatomy, and his accurate observations of nature.

What most impresses people today is the wide range of Leonardo's talent and achievements. He turned his attention to many subjects and mastered nearly all. His inventiveness, versatility, and wide-ranging intellectual

Pen and ink over black chalk (1514-1516); Windsor Castle (The Royal Collection © Her Majesty Queen Elizabeth II)



Hurricane is part of a series of drawings called *The Deluge,* which Leonardo produced near the end of his life. In the series, Leonardo attempted to visualize the forces of life and nature.



Red chalk (about 1514); Biblioteca Reale, Turin, Italy (SCALA/Art Resource)

Leonardo's self-portrait was drawn when he was about 60 years old. It is the only existing likeness of the artist.

curiosity have made Leonardo a symbol of the Renaissance spirit. David Summers

Related articles in World Book include:

Airplane (picture: An early design)
Heart (picture: Leonardo da Vinci)
Helicopter (Early designs and experiments)
Jesus Christ (picture: The Last Supper)
John the Baptist, Saint (picture)
Painting (The 1400's)
Parachute (picture: Leonardo da Vinci)
Renaissance (The fine arts; picture: The drawings of Leonardo da Vinci)

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Leoncavallo, *lay OHN kah VAHL loh,* **Ruggiero,** *rood JEH roh* (1857-1919), was an Italian opera composer. He is best known for his two-act opera *Pagliacci* (1892). This opera is a violent tragedy about a group of traveling players. It is an example of a melodramatic form of realism called *verismo.* Leoncavallo wrote the words and the music, basing the story on a legal case handled by his father, a lawyer. Leoncavallo was inspired to write the opera by the success of Pietro Mascagni's one-act verismo opera, *Cavalleria Rusticana* (1890). The two works are usually performed together.

Leoncavallo was born in Naples and studied music there. Before settling on a career in opera, he worked as a traveling cafe pianist. He wrote many operas, but none of his other works matched the success of *Pagliacci.*

Thomas Bauman

See also **Opera** (Verismo opera; The opera repertoire [*Pagliacci*]).

Leonidas I, *lee AHN ih duhs* (?-480 B.C.), was a king of ancient Sparta. Little is known about his life, but his heroic death at Thermopylae is one of the most famous episodes in history (see **Thermopylae**).

Leonidas became king of Sparta about 488 B.C. The Persian king, Xerxes, invaded Greece in 480 B.C., with a large army. Leonidas, with a much smaller army of up to 10,000 Greeks, tried to stop the Persians at Thermopylae, a narrow pass between mountains and sea. The Greeks held the pass for two days. Then the Persians found a new path over the mountains and threatened the Greeks from the rear. Leonidas sent most of the Greeks to safety in southern Greece. But Leonidas, 300 other Spartans, and hundreds of other Greeks died defending Thermopylae. Thomas W. Africa

Leonids, *LEE uh nihds,* are meteors that seem to come from the constellation Leo. The *meteoroids* (particles or chunks of matter in space) that cause the Leonids travel around the sun in an orbit that the earth crosses about November 17 each year. They become visible when they enter the earth's atmosphere.

In most years, few Leonids are seen. However, heavy Leonid meteor showers occur every 33 years when the earth passes through the thickest part of the meteoroid swarm. The next heavy Leonid shower is expected to take place in 2032. Lee J. Rickard

Leopard is a large member of the cat family. It is the third largest cat of the Eastern Hemisphere. Only the lion and the tiger are larger. Leopards live in Africa as far north as the Sahara, and in Asia from Turkey to Korea and Java.

Leopards are graceful, alert, and cunning. They average 2 feet 4 inches (71 centimeters) high at the shoulder and 7 feet 6 inches (2.3 meters) long. But a big male may measure almost 9 feet (2.7 meters) from nose to tail and weigh from 100 to 160 pounds (45 to 73 kilograms). A big female may weigh about 75 pounds (34 kilograms). Leopards bear two, three, or four young in a litter.

The coat of most leopards is light tan with many dense black spots. The tail has dark rings around it. All leopards are much alike, but those that live in forests are darker than those that live on open plains and desert scrub. The black leopard is so dark that the spots are hard to see. The whole animal looks black. Black leopards are often called *panthers.* Albinos are much rarer than the black variety, which is found in Malaysia, Java, and India.

These fierce animals eat meat and hunt their prey. They feed on such animals as monkeys, antelope, muntjacs, jackals, peacocks, snakes, sheep, goats, and dogs. In Africa, they even kill the big porcupines that have quills 1 foot (30 centimeters) or more in length.

Leopards seldom attack human beings. However, once they discover that people are easy victims, leopards may become more dangerous than tigers or lions. Leopards are good climbers and spend part of their time in trees. They are unbelievably strong. Carcasses of prey weighing 80 to 150 pounds (36 to 68 kilograms) have been found in trees 12 to 20 feet (4 to 6 meters)



Giuseppe Mazza

The powerful and graceful leopard lives both on the ground and in trees. On the ground, this skillful hunter blends in with the surroundings as it stalks its prey. After making a kill, a leopard may drag the animal up a tree and store the prey there until it is hungry.



Bob and Ira Spring

above the ground where a leopard had carried them.

The handsome markings of the leopard make its fur valuable for coats. So many leopards have been killed for their fur that the animals have become rare in many places, and several subspecies face possible extinction. Many countries have signed treaties forbidding the buying or selling of leopard skins. Duane A. Schlitter

Scientific classification. The leopard belongs to the cat family, Felidae. It is *Panthera pardus.*

See also Cat; Snow leopard.

Leopard cat. See Ocelot.

Leopard frog. See Frog (Kinds of frogs; picture).

Leopardi, *lay oh PAHR dee,* **Giacomo** (1798-1837), was an Italian lyric poet. He was sickly and physically deformed, and felt lonely and unloved despite the brilliance of his career. Leopardi's poems are sensitive expressions of the despair and suffering he felt in his life. But the pessimistic tone in his poetry is often softened by hope in the future and an underlying love of life.

Leopardi's verse collections include *Idylls* (1825) and *Songs* (1836). His other important work is *Le operette morali* (*Moral Essays,* 1824-1832). In this series of essays, Leopardi reinterpreted historical figures and ancient myths and legends in order to show their timeless significance.

Leopardi was born on June 29, 1798, in Recanati. By age 16, he had mastered several languages and was writing scholarly essays as well as poetry. Richard H. Lansing

See also Italian literature (Romanticism).

Leopold, Aldo (1887-1948), was an American naturalist, wildlife biologist, and conservationist. He pioneered the application of ecological principles to wildlife management. An enthusiastic outdoorsman, he believed that people should enjoy wilderness areas for recreation. But he declared that the natural characteristics of such areas should be preserved as much as possible.

Leopold wrote books and articles that emphasized conservation. His textbook *Game Management* (1933) is considered a classic. *A Sand County Almanac* (1949) and *Round River* (1953) include many of Leopold's philosophic essays on conservation. These essays stress the need for wilderness areas.

Leopold was born on Jan. 11, 1887, in Burlington, Iowa. He graduated from Yale University in 1908 and earned a Master of Forestry degree there in 1909. He worked for the U.S. Forest Service from 1909 to 1927. He was on the faculty of the University of Wisconsin from 1933 until his death. A biography, *Aldo Leopold: His Life and Work,* was published in 1987. G. J. Kenagy

Léopoldville. See Kinshasa.

Lepanto, Battle of. See Turkey (The Ottoman decline); Cervantes, Miguel de.

Lepidoptera. See Insect (table).

Leprechaun. See Fairy.

Leprosy, also called *Hansen's disease,* is a chronic infectious disease. It primarily affects the skin; the mucous membranes, especially those in the nose; and the *peripheral nervous system,* which includes nerves that connect the spinal cord to the muscles. In advanced cases of the disease, the eyes, liver, spleen, muscles, and bone marrow can also be affected. Leprosy is not usually fatal. However, patients with untreated or neglected infections may develop crippling deformities of the hands and feet.

Through the years, people with leprosy have been the victims of fear and prejudice, largely because of the deformities associated with the disease. In many societies, people with leprosy have been made outcasts from their communities.

Causes. Leprosy results from infection by a rod-shaped bacterium called *Mycobacterium leprae,* sometimes known as *Hansen's bacillus.* The Norwegian physician Gerhard H. Armauer Hansen first observed *M. leprae* bacteria in tissue specimens from leprosy patients in 1873. The following year, he proposed that the bacteria caused leprosy.

M. leprae infection occurs primarily in human beings. But the bacteria also have been found in armadillos, chimpanzees, and mangabey monkeys. Researchers do not know exactly how the bacteria are transmitted. Most evidence suggests that people become infected by inhaling the bacteria. However, some cases have reportedly resulted from skin-to-skin contact.

Symptoms. Most people who are exposed to *M. leprae* resist infection and develop immunity after this exposure. Only a few actually develop the disease. Symptoms of leprosy typically appear three to five years after infection.

The chief symptoms of leprosy include white or reddish patches of skin, called *skin lesions;* the loss of feeling in the skin lesions; and thickened nerves. The skin may also thicken, and dark *nodules* (lumps) may appear on many parts of the body. If the disease is not treated, nerves can become severely damaged, causing weakness in the hands and feet. As a result, the fingers and toes may curl inward. If *M. leprae* enter the eyes, a painful inflammation called *iritis* can occur. In severe cases, the bacteria can cause blindness.

There are two main forms of leprosy: (1) *tuberculoid* and (2) *lepromatous.* Most patients with the tuberculoid form have only one or a few lesions with few, if any, *M. leprae* detectable in the tissue. Most patients with the lepromatous form have multiple lesions containing billions of bacteria per gram of tissue.

Treatment. No effective, reliable vaccine to prevent leprosy has been developed. However, certain drugs can halt the progression of leprosy and can rapidly make the patient noninfectious. The sulfa drug dapsone has served as the chief medicine used to treat leprosy since the late 1940's. However, by the early 1980's, an alarming number of leprosy cases resistant to dapsone therapy had occurred.

To combat the dapsone-resistant bacteria, physicians now treat patients with combinations of two or three drugs. Patients with few lesions and few bacteria per lesion are treated for six months with both dapsone and the antibiotic rifampin. Patients who have many lesions or many bacteria per lesion are treated for two years with dapsone, rifampin, and another drug, clofazimine.

More than 1 ½ billion people live in areas where leprosy is *endemic* (regularly found). Consequently, in addition to treatment of individual cases, public health measures are needed to combat the disease. For centuries, public health programs consisted of simply isolating patients and confining them to hospitals called *leprosariums.* This approach probably had little effect on the spread of the disease and did little good for the patient. It also did nothing to remove the fear and prejudice surrounding leprosy, which still hinder relief efforts in many parts of the world today.

Modern control programs have a twofold emphasis. They stress (1) community-based screening to detect cases of leprosy and (2) educating the community about the disease. Early detection and treatment can halt transmission of *M. leprae* in the community and can greatly reduce development of the disabilities associated with the disease. As a result, many screening programs include the medical examination of everyone in a school or community and drug therapy for all who are infected. Education of the community concentrates on reducing the fear of leprosy and encouraging infected individuals to seek treatment.

History. Historians do not know where or when leprosy originated. The word *leprosy* appears in the Bible, but probably refers to a variety of skin diseases, and not to leprosy alone. The first accurate description of leprosy appeared before A.D. 300 in the writings of the Indian physician Sushruta.

Leprosy entered Europe in the 400's B.C. Some historians think it may have been introduced by the troops of the Persian ruler Xerxes as they invaded Greece in the 400's B.C. The disease spread slowly through the Mediterranean and then to the rest of Europe.

Leprosy reached epidemic proportions in western Eu-



Mycobacterium leprae, a rod-shaped bacterium, causes leprosy. Many appear in this microscopic view.



Skin lesions (white or reddish patches of skin) are a common symptom of leprosy.



D. A. Lopez, M.D.

Nerve damage from leprosy can weaken hand muscles, making fingers curl inward.

rope in the A.D. 1100's and 1200's. It then gradually disappeared from Europe as living conditions and nutrition improved there. However, the disease persisted in Norway until the late 1800's. In the Western Hemisphere, leprosy was unknown until the arrival of European explorers and settlers.

Today, leprosy afflicts 5 million to 6 million people worldwide. It is endemic in tropical or subtropical regions, including Africa, Central and South America, India, and Southeast Asia. Small pockets of the disease can also be found in southern Europe. In the United States, fewer than 300 new cases of leprosy appear annually. Most such cases of leprosy occur among immigrants from areas where the disease is endemic.

Thomas M. Shinnick

See also **Damien de Veuster, Joseph.**

Lepton, *LEHP tahn,* is one of the three major families of elementary particles. The other families are *quarks* and *bosons.* Most physicists believe leptons are fundamental units of matter—that is, the particles do not consist of smaller units.

Physicists have identified six types of leptons—*electrons, muons, taus,* and three kinds of *neutrinos.* Electrons, muons, and taus have a negative electric charge. Muons and taus have a much larger mass than that of electrons. A muon is about 207 times as heavy as an electron, and a tau is 3,477 times as heavy. No difference has been found between electrons, muons, and taus other than their mass.

The three kinds of neutrinos have no electric charge. They are called *electron-, mu-,* and *tau-neutrinos* because each is associated with one type of charged lepton. Their mass has so far proved to be too small to measure.

All leptons have antimatter counterparts that are called *antileptons.* Antileptons have the same mass as leptons, but all the other properties are reversed. Because neutrinos have no charge, their antiparticles also are neutral.

Muons and taus are unstable particles, and so they *decay* (break down) into lighter particles. A muon decays into an electron, a mu-neutrino, and an electron-antineutrino in about 2 millionths of a second. The lifetime of a tau is less than 2 trillionths of a second. A tau, because of its large mass, can decay into many different combinations of lighter particles. Robert H. March

See also **Antimatter; Muon; Neutrino.**

Lerner, Alan Jay (1918-1986), was one of the greatest lyricists of the American musical theater. His best lyrics display a wit and literacy rare in musical theater. Lerner's most memorable work was done with Vienna-born composer Frederick Loewe. They first teamed up in 1942, and their greatest success was the musical comedy *My Fair Lady* (1956). They also created the hit musicals *Brigadoon* (1947), *Paint Your Wagon* (1951), and *Camelot* (1960), as well as the motion-picture musical *Gigi* (1958). Lerner and Loewe won Academy Awards for the title song, and Lerner also won an Academy Award for the film's screenplay.

Lerner collaborated with composers Kurt Weill on *Love Life* (1948), Burton Lane on *On a Clear Day You Can See Forever* (1965), and Andre Previn on *Coco* (1969). In addition to lyrics, Lerner wrote the *libretto* (dialogue) for many of his musicals. He won an Academy Award in 1951 for writing the screenplay for *An American in Paris.* Lerner was born in New York City. Lerner discussed his composing career in *The Street Where I Live* (1978).

Gerald Bordman

Lesage, *luh SAZH,* **Alain René,** *a LAN ruh NAY* (1668-1747), was a French novelist and dramatist. He first practiced law, but left this career to become a writer. He was among the first to earn his living by writing. Lesage's most famous work, the novel *Gil Blas* (1715-1735), is a witty satire set in Spain. The story is told in the first person by Gil Blas, who learns to his sorrow that life can be harsh when one has to make one's own way without help. His innocence and vanity make him an easy victim. Lesage's most notable play is *Turcaret* (1709), a satirical comedy of the manners and behavior of financial speculators. Lesage was born in Sarzeau. Thomas H. Goetz

Lesbos, *LEHZ bahs,* also spelled *Lesvos,* is a mountainous Greek island in the Aegean Sea. It covers 832 square miles (2,154 square kilometers) and has about 104,000 people. Mitilini (also spelled Mytilene) is its largest city. The entire island is sometimes called *Mitilini.* The economy of Lesbos is centered around agriculture. The island produces olives, olive oil, grapes, and tobacco. Other economic activities include tourism, soapmaking, and the quarrying of marble.

A local legend says that Lesbos' people descend from the mythical Greek warrior Agamemnon. The legend says Agamemnon conquered Lesbos in the Trojan War, which probably took place in the 1200's B.C. From the late 1100's through the 900's B.C., many Aeolians from mainland Greece moved to Lesbos. Lesbos was a cultural center from about 600 B.C. to the end of the Golden Age of Greece in 431 B.C. The poet Sappho lived there (see **Sappho**). Turks controlled Lesbos from 1462 until Greece annexed it in 1913. John J. Baxevanis

Lesch-Nyhan syndrome is a rare hereditary disease that can cause mental retardation. Lesch-Nyhan syndrome results from a deficiency of *hypoxanthine-guanine phosphoribosyl transferase,* an enzyme found in all body cells. This enzyme is present in particularly high levels in the *basal ganglia* of the brain. The basal ganglia help control unconscious body movements. In addition to mental retardation, symptoms of Lesch-Nyhan syndrome include uncontrollable movements and a tendency to inflict self-injury.

Patients inherit the syndrome through a defective gene on the X chromosome, one of the two chromosomes that determine sex. Males have one X chromosome and one Y chromosome, and females have two X chromosomes. A male who inherits the defective gene will develop the disease. But a female develops the disease only when the defective gene occurs on both X chromosomes. A female who carries the defective gene can transmit the defect to her children.

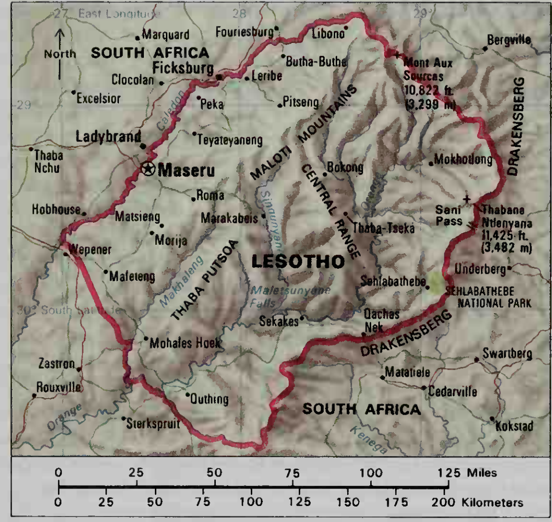
Lesch-Nyhan syndrome cannot be cured or effectively treated. The disease was first described in 1964 by William Nyhan, an American professor of medicine, and one of his students, Michael Lesch. C. Thomas Caskey

Lesotho, *lay SOO too* or *luh SOH toh,* is a rugged, mountainous country that is completely surrounded by the Republic of South Africa. It lies about 200 miles (320 kilometers) inland from the Indian Ocean. Lesotho is sometimes called the *Switzerland of Southern Africa* because of its beautiful mountain scenery. But it is a poor

Lesotho

(red line)	International boundary
(line)	Road
(line)	Railroad
⊛	National capital
•	Other city or town
+	Elevation above sea level





WORLD BOOK maps

country. It has only a few manufacturing industries. Many of its people go to South Africa to find jobs.

Lesotho was formerly governed by the United Kingdom as the protectorate of Basutoland. It became independent in 1966. Maseru is its capital and largest town (see Maseru).

Government. Lesotho is a constitutional monarchy. A king is the head of state. However, the king has no official power. A prime minister and a cabinet carry out the operations of the government. Lesotho's parliament consists of a National Assembly and a Senate. The people

Facts in brief

Capital: Maseru.
Official languages: English and Sesotho.
Official name: Kingdom of Lesotho.
Area: 11,720 mi² (30,355 km²).
Population: *Estimated 2002 population*—2,237,000; density, 191 per mi² (74 per km²); distribution, 84 percent rural, 16 percent urban. *1986 census*—1,447,000.
Chief products: *Agriculture*—beans, cattle, corn, goats, mohair, peas, sheep, sorghum, wheat, wool.
Flag: The flag has diagonal stripes of white, blue, and green. A shield that is part of the country's coat of arms appears in the upper left. The flag was adopted in 1987. See **Flag** (picture: Flags of Africa).
Money: *Basic unit*—loti. One hundred lisente equal one loti.
National anthem: "Lesotho Fatse La Bo-Ntata Rona" ("Lesotho Our Fatherland").

elect the 120 members of the Assembly. The Senate consists of 22 local chiefs and 11 other members who are appointed by the king. The prime minister is the leader of the party that wins a majority of seats in the National Assembly. The prime minister appoints cabinet members. Lesotho is divided into 10 administrative districts for purposes of local government. Each district is headed by a district secretary.

People. Most of Lesotho's people are black Africans called Basotho (also spelled *Basuto*). Many Basotho raise livestock and food crops. The wealth of a family is often measured by the number of cattle it owns. Most Basotho live in villages of fewer than 250 people. Family groups build their huts around a cattle *kraal* (pen) with open space separating each group. Traditional houses consist of mud or sod walls with thatched roofs. The Basotho often paint designs on the doors and walls. Wealthy Basotho live in stone houses with roofs of tin or tile. Each village has a *khotla* (meeting place) where men discuss village business.

The Basotho raise crops on the land surrounding the villages. All land is owned in common by the people, and local chiefs assign the land to the people.

The women do most of the heavy work on the farms and in the homes. They hoe and weed the land, harvest

© Dennis E. Cox, Click/Chicago



Lesotho's capital, Maseru, lies near the northwestern border of the country. The national coat of arms is displayed on a pole, *upper right corner,* on the main street of the city.



© Dennis E. Cox, Click/Chicago

A small Lesotho village lies in a mountain valley east of the capital, Maseru. Most of the people of Lesotho live in villages. Their houses have mud or sod walls and thatched roofs.

the crops, and build the houses. The men plow the land and look after the sheep, cattle, and goats. From the time they are 5 or 6 years old, boys herd livestock. On farms in the western plains, they return home with their herds every night. In the eastern highland areas, boys often spend months away from home, moving about with their flocks and herds in search of pasture.

Corn, sorghum, milk, and vegetables are the chief foods of the people. The women brew sorghum beer. In the 1800's, the Basotho wore clothes that were made from animal skins. Most of them now wear Western-style clothing, but they often wrap themselves in blankets to keep warm.

English and Sesotho, a Bantu language, are the country's two official languages. The traditional religions of the people are based on ancestor worship (see **Ancestor worship**). But more than 80 percent of Lesotho's people now are Christians.

About 75 percent of the children in Lesotho attend elementary school, and most of the adults are able to read and write. About two-thirds of all schoolchildren are girls, because many boys spend their youth herding livestock. Missionaries run most of the schools. The National University of Lesotho is located in Roma.

Land. Most of Lesotho is mountainous. The Drakensberg, a mountain range, rises to over 11,000 feet (3,400 meters) above sea level in the east. The Maloti (also spelled Maluti) Mountains, which are a part of the Drakensberg, cover much of central Lesotho. The only plains lie in the west. The Orange River rises in northeastern Lesotho.

Most of Lesotho has a mild, moist climate because most of the country lies more than 5,000 feet (1,500 meters) above sea level. The rainfall varies from year to year and place to place. Annual rainfall averages 28 inches (71 centimeters), and most of it falls between October and April. Temperatures in the western plains range from 90°F (32°C) in summer to 20°F (-7°C) in winter. In the highlands, snow falls and temperatures often fall below freezing in the winter.

Economy. The most important economic activity within Lesotho is raising cattle, goats, and sheep. Farmers grow asparagus, beans, corn, peas, sorghum, and wheat. The best farming land lies in the western plains, where about two-thirds of the people live. Over-cultivation and overgrazing have damaged Lesotho's soil. Lesotho manufactures clothing, textiles, and furniture and processes some agricultural products. The country has some diamond deposits.

Lesotho does not have enough jobs for its people. At any one time, almost half of all the men are working in South Africa in mines, factories, farms, or households. Generally, they work on contracts that last from several months to two years. The money that these *migrant laborers* earn in South Africa is vital to the economy of Lesotho. The migrant labor is the country's most important economic activity. The law provides that 60 percent of each of the migrant worker's wages must be deposited in the Lesotho Bank. The worker's family is allowed to withdraw half of the funds, but the other half must stay in the bank until the worker returns from South Africa. This system enables the government, which owns the bank, to invest in development projects.

Most of the country's roads lie in the western plains. In the highland areas, the Basotho travel on hardy ponies and horses along winding trails.

History. Ethnic wars swept over southern Africa in the late 1700's and early 1800's. Many ethnic groups were almost completely wiped out and their homes were destroyed. Some of the victims of this fighting fled into the highlands of what is now Lesotho. There they were given protection by an African chief named Moshoeshoe. He built a stronghold on a hill called *Thaba Bosiu* (Mountain of Night), about 15 miles (24 kilometers) from where Maseru now stands. By 1824, he had about 21,000 followers. He united them into the Basotho nation.

Later, British and Boer settlers tried unsuccessfully to defeat the Basotho (see **Afrikaners**). From 1856 to 1868, the Basotho were at war with Boer settlers. In 1868, Mo-

shoeshoe asked the United Kingdom for protection. The United Kingdom established the protectorate of Basutoland. Moshoeshoe died in 1870, and in 1871 the territory was placed under the rule of the British Cape Colony, now part of South Africa. In 1884, Basutoland was reestablished as a British protectorate governed by a British colonial administrator. In 1910, the Basutoland Council was formed. Consisting of chiefs and elected members, it served as the national legislative council.

A Constitution was drawn up in 1960 and revised in 1964. The first general election under this Constitution was held in 1965. The Basutoland National Party (BNP) won a majority of the seats in the new National Assembly, and Chief Leabua Jonathan, the BNP leader, became prime minister. Paramount Chief Motlotlehi Moshoeshoe II, great-grandson of Moshoeshoe, became king. In 1966, the protectorate of Basutoland became the independent kingdom of Lesotho.

During a general election in 1970, early vote returns showed the BNP losing its majority. Chief Jonathan then suspended the Constitution and elections. He continued to rule Lesotho as prime minister. In 1986, military leaders overthrew Chief Jonathan and took control. In 1990, the government forced King Moshoeshoe II to leave office and installed his eldest son as King Letsie III.

In 1993, Lesotho returned to a civilian government. In a multiparty election, the Basotho Congress Party (BCP) won all the seats in the National Assembly. In 1995, Letsie III gave up the throne, and his father was reinstated as King Moshoeshoe II. Moshoeshoe II died in 1996. His eldest son returned to the throne as King Letsie III.

In 1997, a large faction of the BCP broke away and formed a new party, called the Lesotho Congress for Democracy (LCD). In elections held in May 1998, the ruling LCD won almost all the seats in the Assembly. Opposition parties claimed that the elections were fixed, and protests broke out against the government. In September 1998, South Africa and Botswana sent troops to Lesotho in support of the government. After much bloody fighting, an agreement was reached between the government and the opposition calling for new elections. In the elections, held in May 2002, the LCD kept control of the Assembly. Louis A. Picard

See also Maseru; Orange River.

Lespedeza, *LEHS puh DEE zuh,* is the name of a group of herbs and shrublike plants that grow in Asia, Australia, and North America. Shrubby lespedezas are called *bush clover.* Lespedeza leaves have smooth edges and three leaflets. The small, pea-shaped flowers grow in clusters. The fruit is a short pod with one seed. *Japanese lespedeza* and *Korean lespedeza* have been grown chiefly in the southern United States as livestock feed and as a fertilizer. Roy E. Gereau

Scientific classification. Lespedezas belong to the pea family, Leguminosae.

Lesseps, Ferdinand Marie de. See De Lesseps, Ferdinand Marie.

Lessing, Doris (1919-), is an English writer noted mainly for her novels. Her fiction reflects her cosmopolitan awareness of racial and class inequities. It also shows a deep concern for moral, political, and psychological attitudes and for women's roles in society. Most of her works stress the complexity of life and deal with humanity's struggle to understand the world.

Lessing was born on Oct. 22, 1919, in Kermanshah, Persia (now Bakhtaran, Iran) and grew up in Rhodesia. She moved to England in 1949. Her first highly praised novel, *The Grass Is Singing* (1950), and a series of semi-autobiographical novels, *The Children of Violence* (1952-1969), describe the difficulties of white women living in Africa and the problems of left-wing anticolonialists.

Lessing's most famous novel is the feminist political classic, *The Golden Notebook* (1962). It brilliantly describes the anxiety and confusion that a woman encounters in the modern world. In *The Summer Before the Dark* (1973), Lessing explored the subject of middle age. *The Sweetest Dream* (2002) is a political novel set in the 1960's. Lessing has written a series of five philosophical science-fiction novels called *Canopus in Argos: Archives* (1979-1983). She has also written plays, poems, short stories, and the autobiographies *Under My Skin* (1994) and *Walking in the Shade* (1997). Linda Wagner-Martin

Lessing, Gotthold Ephraim, *GOHT hohlt AY frah ihm* (1729-1781), was a German playwright, critic, and philosopher. Lessing helped free German writing from neoclassical French influences. He turned the attention of German writers to English literature, especially the works of William Shakespeare. Lessing introduced English middle-class tragedy into Germany with his dramas *Miss Sara Sampson* (1755) and *Emilia Galotti* (1772). His play *Minna von Barnhelm* (1767) is one of the greatest German comedies. It was the first German play with a German background of that time. Its sentimental but realistic style influenced German popular theater throughout the 1800's.

While serving as a theater critic in Hamburg, Lessing wrote *The Hamburg Dramaturgy* (1767-1769). The work began as reviews of performances. It later became a series of essays in which Lessing discussed the drama of his time in relation to Aristotle's principles for tragedy. In his essay *Laokoön* (1766), Lessing discussed the relationship between poetry and painting. The essay is basic



Kitty Kohout, Root Resources

Lespedeza plants have clusters of small red flowers.

to classical German ideas of beauty.

Lessing was the first German playwright to put a sympathetic Jew on stage in *The Jews* (1749). His final drama, *Nathan the Wise* (1779), is his testament on religious tolerance. His *Education of the Human Race* (1780) also pleads for tolerance. It was one of the first German essays on the philosophy of history. Lessing was born in Saxony. Klaus L. Berghahn

See also **German literature** (The Enlightenment).

Le Sueur, *luh SOOR,* **Pierre-Charles,** *pyair shahrl* (1657?-1704), was a French explorer and trader. He helped open the upper Mississippi River Valley to French development.

Le Sueur was born in Artois, a region of northern France. In his youth, he moved to Canada as a servant of Jesuit missionaries. He was soon drawn to the fur trade and became a successful trader among the Sioux Indians. In 1695, he arranged for a peace agreement between the Sioux and Chippewa Indian tribes. In 1700, Le Sueur traveled up the Mississippi River from its mouth in the Gulf of Mexico. He established several posts in what is now the Minnesota-Wisconsin region. He worked to expand trade with Indians in the region and to develop copper and lead mines there. In 1702, he was appointed a French colonial judge in what is now Alabama. S. Dale Standen

Lethal injection of drugs is the most frequently used method of executing criminals in the United States. A fast-acting *barbiturate* (sedative) is first injected to put the prisoner to sleep. Two additional drugs are then injected to stop the prisoner's breathing and heartbeat. Death usually occurs within minutes after the injections.

The first U.S. state to adopt lethal injection was Oklahoma in 1977. The first execution by lethal injection occurred in Texas in 1982.

Some people believe that lethal injection is more humane than other means of execution, such as the electric chair and the gas chamber. People who oppose the death penalty, however, argue that any method of execution is inhumane. Most condemned prisoners who have had a choice between lethal injection and other methods of execution have chosen the injection.

Franklin E. Zimring

Lethbridge (pop. 67,374) is a city in southern Alberta. It lies in an agricultural area on the Oldman River, about 145 miles (233 kilometers) southeast of Calgary (see **Alberta** [political map]). Lethbridge is a processing and distribution center for farm products. It has a brewery and stockyards. Its factories make food products, housing units, metal products, and telecommunications products.

The city began as a coal-mining settlement in the 1870's. The community was known as Coalbanks until 1885, when its name was changed to Lethbridge. It was incorporated as a town in 1891 and became a city in 1906. The city has a council-manager government.

James P. Haskett

Lethbridge, University of, is a coeducational, provincially funded university in Lethbridge, Canada. The university offers a master's degree program in education and bachelor's degree programs in arts and science, education, management, nursing, and the fine arts. The University of Lethbridge was founded in 1967.

Critically reviewed by the University of Lethbridge

Lethe, *LEE thee,* was one of five rivers in the underworld in Greek and Roman mythology. These rivers served as a boundary between the land of the living and the land of the dead. *Lethe* is a Greek word meaning *forgetfulness.* Drinking from Lethe caused the souls of the dead to forget what happened to them on earth. Those souls that were to be *reincarnated*—that is, reborn in new bodies—drank from Lethe to forget their former lives and their existence in the underworld. Many poets have used Lethe as a symbol of forgetfulness or of a deathlike sleep. Justin M. Glenn

See also **Hades.**

Letter. See **Alphabet; Letter writing.**

Letter writing is a way of communicating a message in written words. People write letters for both business and personal reasons. Business letters are generally more formal than personal letters. Business letters include those used to apply for jobs, complaint letters, sales letters, and collection letters. Personal letters include correspondence between family members or friends, invitations, and thank-you notes.

Studies show that people who write well are more likely to have successful careers. Skill in writing business and personal letters can make a difference in your life. For example, a well-written letter applying for a job



Vincent van Gogh Foundation/National Museum Vincent van Gogh, Amsterdam

A letter from Vincent van Gogh to his brother Theo includes two sketches of rural scenes in the Netherlands about 1885. The famous painter wrote nearly 1,000 letters during his lifetime, often several a day. Many contained striking drawings.

may lead to a fine position. A good personal letter can help build or keep a valuable friendship.

Characteristics of a good letter

A well-written letter should be clear, accurate, complete, concise, and courteous. The first step in preparing a good letter is deciding what to say. Make a brief list of the ideas you want to cover, and then plan the arrangement of these ideas. Next, decide how best to put your thoughts into words. It may help to write a rough copy of your letter simply to get the words on paper. Finally, go back and fix the sentence structure, grammar, and wording. Use simple, direct statements rather than long, involved sentences. Make each phrase easy for the reader to understand.

Be sure every statement in the letter is accurate. Business firms write letters every day just to clear up mistakes they made in previous letters. These follow-up letters would not be necessary if writers would take the time to give the facts correctly in their first letters.

Think carefully about your reader's familiarity with your topic. Have you included everything the reader needs to know? Forgetting even one necessary item can create confusion. If the letter discusses an appointment, be sure you mention the location, date, and time.

Say what you have to say and then stop. Too often, letters become cluttered with wordy phrases, stuffy expressions, and unnecessary details that dilute your message. Use plain, natural language and get to the point.

The tone of the letter is as important as its language. In general, make the tone friendly and polite. Stress points that will interest the reader.

The parts of a letter

A letter has six standard parts. They are (1) the heading, (2) the inside address, (3) the salutation, (4) the body, (5) the complimentary close, and (6) the signature.

The heading in a business letter includes the writer's address and the date. It is located on the top of the page, and it usually has three lines. The first line gives the writer's street address, and the second gives the city, state, and ZIP Code. The third tells the date the letter was written. Most of the heading may be omitted in a personal letter, but always include the date.

Business firms have printed or engraved letterheads that provide their name, address, and telephone number. Some also add the name or title of the writer, or the writer's department or section.

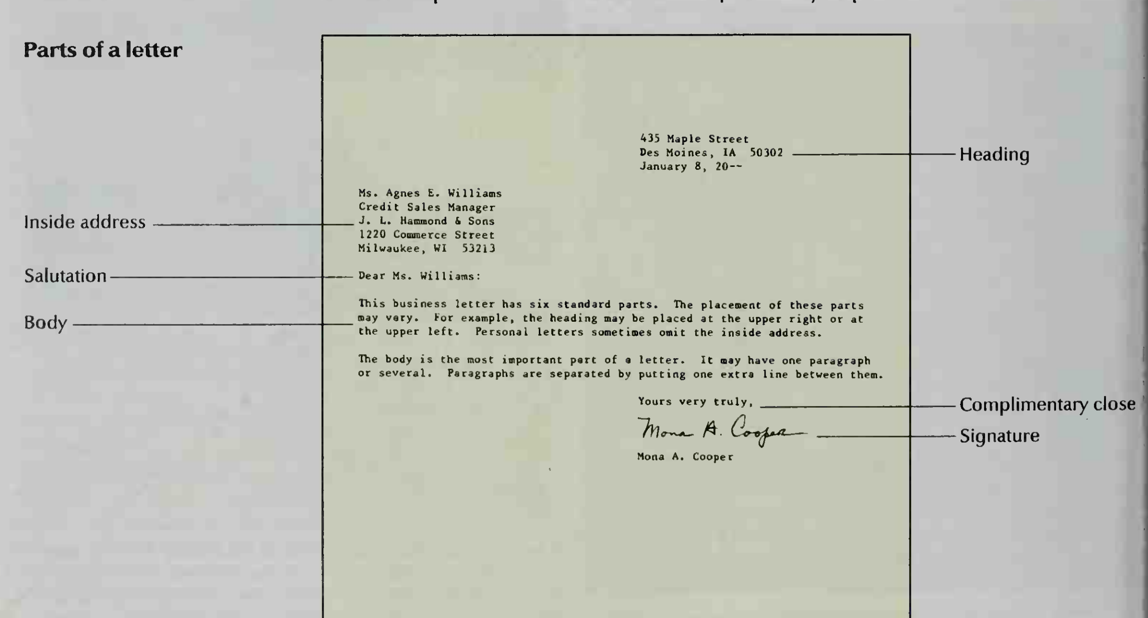
The inside address shows the name and address of the *recipient*—that is, the person or firm to whom the letter is written. In many business letters, the inside address can be written in three lines. The name of the recipient appears on the first line; the street address on the second; and the city, state, and ZIP Code on the third. The inside address of a letter directed to an individual in an office should include the person's business title and the name of the firm. Most names and titles should be written out in full. However, some abbreviations of titles are commonly used, especially *Dr., Mr., Mrs.,* and *Ms.* See **Address, Forms of.**

The first line of the inside address should be placed at least two lines lower than the date. An inside address should appear in all business letters, but it is optional in personal letters.

The salutation is also called the greeting. It should begin two lines below the last line of the inside address. In business letters, the most common salutation combines a title and the person's last name, such as *Dear Ms. Dobson* or *Dear Dr. Davis.* Use *Dear Sir or Madam* when the recipient's name is unknown or when writing to a company. Call friends by their first name or a nickname, such as *Dear David* or *Dear Cindy.* Use a colon after the salutation in a business letter, but use a comma in a personal letter.

The body contains the writer's actual message. In a typewritten letter, the body should begin two lines below the salutation. All paragraphs within the body should be separated by a space of one extra line.

Parts of a letter



435 Maple Street
Des Moines, IA 50302
January 8, 20--

Ms. Agnes E. Williams
Credit Sales Manager
J. L. Hammond & Sons
1220 Commerce Street
Milwaukee, WI 53213

Dear Ms. Williams:

This business letter has six standard parts. The placement of these parts may vary. For example, the heading may be placed at the upper right or at the upper left. Personal letters sometimes omit the inside address.

The body is the most important part of a letter. It may have one paragraph or several. Paragraphs are separated by putting one extra line between them.

Yours very truly,

Mona A. Cooper

Mona A. Cooper

The complimentary close. Just as the salutation greets the reader at the beginning of a letter, the complimentary close says good-bye at the end. These two parts of the letter should be consistent in their degree of formality.

In a letter that opens with *Dear Mr. Caldwell* or *Dear Sir or Madam,* the complimentary close could be *Yours truly* or *Very truly yours.* For an informal closing, *Cordially* or *Best regards* is appropriate. If the salutation is *Dear Bill,* proper closings include *Sincerely, Cordially,* and *With warmest regards.* The complimentary close should end with a comma. The close should be placed two lines below the body of the letter.

The signature is the writer's name. It should be handwritten in ink below the complimentary close. In typewritten letters, the writer's name should be typed four or five lines below the complimentary close, with the handwritten signature placed between the closing and the typewritten signature. The writer may add his or her title in parentheses to the left of the typewritten name, as in *(Dr.) Jackson Baty* or *(Ms.) Leigh Rigby.* The abbreviation *Ms.* has now largely replaced *Miss* or *Mrs.* Many women prefer this title because it does not reveal their marital status. However, a married woman might add her married name in parentheses beneath her legal name, as in *Annie Peters* with *(Mrs. Kevin Peters)* written beneath it. In some companies, the writer's business title or department is placed on the line beneath the typed signature. The company's name may also be included with the signature, though most firms omit it.

The form

The form of a letter depends on the way the six parts of the letter are arranged on the page. The most common forms are *full block* and *semiblock.* Each may be used for both business and personal letters.

The full block form is the most commonly used form, probably because it is the easiest and quickest to type. All parts of a letter in the full block form begin at the left margin. New paragraphs are not indented. An extra line of space separates the paragraphs.

The semiblock form is less formal than the full block form. The heading is placed in the upper right-hand corner. Both the complimentary close and the typed signature line up vertically with the heading. All other parts of the letter begin at the left margin. New paragraphs are not indented. An extra line of space separates the paragraphs.

The envelope address usually is the same as the inside address of the letter. It is most commonly centered on the envelope. The address should be at least three lines long. Use the capitalized, two-letter post office abbreviation for the state or province (see **Post office** [table: Postal service abbreviations]). The writer's return address goes in the upper left-hand corner of the envelope. Always single-space addresses.

Business letters

There are many kinds of business letters. However, the same principles of good writing apply to each kind. This section describes two types of typical business letters—letters of application and complaint letters. This section also offers several suggestions that are helpful in most business letters.

Letters of application are written by people seeking a job. This type of letter normally consists of two parts, the *cover letter* and the *resume.* A cover letter introduces the applicant to the employer. It accompanies a resume, which is a biographical summary listing the applicant's education and work experience. For more information about resumes, see **Careers** (Writing a resume).

The first paragraph of the cover letter tells what job the writer is applying for and how the applicant found out about the position. In the next one or two paragraphs, the writer should briefly emphasize the parts of his or her background that relate most closely to the job. United States law prohibits employers from asking applicants their sex, race, religion, nationality, or marital status. Thus, including such information is optional. The letter should be no more than three or four paragraphs. In the final paragraph, the applicant should politely ask the employer to reply and to schedule a job interview.

A letter of application can also combine the information that is in a cover letter and resume. It is usually two



World Book, Inc.
a Scott Fetzer company

March 24, 20- -

Mr. James Roberts
1426 Newton Street
Memphis, TN 31805

Dear Mr. Roberts:

This letter shows the use of the full block form. Each part of the letter begins at the left-hand margin of the page. Paragraphs are not indented.

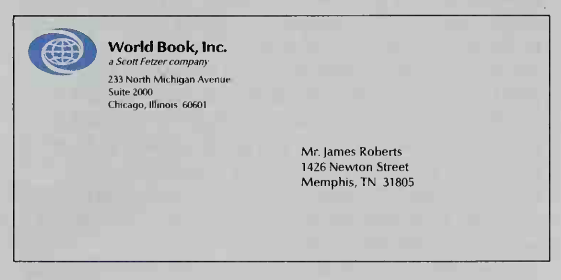
Many letters are written in this form, probably because it is the easiest and quickest to type. The block form is correct for both business letters and personal letters.

Sincerely,
Allen E. Parker
Allen E. Parker
Sales Representative

233 North Michigan Avenue
Suite 2000
Chicago, Illinois 60601

Phone: 312.729.5800
Fax: 312.729.5600
Web: www.worldbook.com

Full block form



World Book, Inc.
a Scott Fetzer company
233 North Michigan Avenue
Suite 2000
Chicago, Illinois 60601

Mr. James Roberts
1426 Newton Street
Memphis, TN 31805

An envelope address should be single-spaced and at least three lines long. It usually is the same as the inside address.

Dear Ms. Jackson:

In response to your company's June 11 classified advertisement in the Chicago Tribune, I am applying for the position of Research Assistant.

I understand the available position involves testing and interviewing employees of major industrial firms. As the enclosed resume indicates, I performed similar tasks for the Office of Evaluation Research at the University of Illinois in Chicago. During my time of employment there, I also attended DePaul University and received a Master's degree in clinical psychology.

I would be glad to schedule an interview with you at your convenience. It is easiest to reach me evenings at the phone number listed above. Thank you for your consideration.

Sincerely yours,

Lee Jones

Lee Jones

A cover letter and a résumé make up a typical job application. The cover letter, *above,* introduces the applicant to the employer. The résumé describes the applicant's background.

Dear Ms. Jackson:

Thank you for your time yesterday afternoon. After such a thoughtful discussion, I am more interested than ever in the Research Assistant position at your firm. I hope to be able to put my experience and enthusiasm to work for you.

Yours very truly,

Lee Jones

Lee Jones

A follow-up letter should be sent within two days after a job interview. This short letter thanks the employer for the interview and expresses continued interest in the job.

or three pages long. Like a cover letter, it should say what job the writer is applying for and point out parts of the applicant's education and experience that best fit the requirements of the job. Most employers prefer a résumé with a cover letter rather than a combined letter of application because the résumé and cover letter are more concise and easier to read.

After a job interview, applicants should send a *follow-up letter,* which is a short letter thanking the employer for the interview. This letter should be sent within two days of the interview. A follow-up letter shows the applicant's continued interest in the job.

Complaint letters are written to call attention to a problem and to persuade the reader to take corrective action. Although it is proper to express disappointment or dissatisfaction, such strong emotions as anger and sarcasm are appropriate only as a last resort after several letters. The tone of the letter may be cool and firm, but it should also be courteous. State the complaint clearly at the beginning of the letter. Include everything the reader needs to know to take action, such as account numbers, relevant dates, and photocopies of bills or canceled checks. Make a specific request for action, and politely ask for a reply.

The reply to a complaint letter should also be courteous. It should open with a polite acknowledgment of the complaint letter. If the complaint is justified, apologize for the problem and explain what action will be taken to correct it. If the complaint is not justified, tactfully explain why the requested action will not be taken. The reply should always end with a positive statement about future dealings and a friendly close.

Improving your letters. It is usually best to deal with only one subject in a business letter. This makes it easier for the reader to file the letter after responding to it. If you need to discuss two or more subjects with the same person, consider writing more than one letter.

When writing to business people, you may want to use a *reference headline.* A reference headline consists of the abbreviation *Re* and a short phrase describing the topic of the letter. Place it at the beginning of the letter just beneath the inside address and before the salutation. By opening with such words as "Re: a design flaw in your new product," you are helping the reader understand your topic at first glance.

Consider putting topic labels, called *headlines,* on different sections or paragraphs of a letter to help clarify for the reader the points you wish to make. For example, copies of your letter may be going to two or more readers who have different levels of familiarity with your subject. In this case, you may want to put a section labeled "Background" towards the end of your letter. People who need this extra information can skim to the back, while those more familiar with the subject will find important facts such as "Results of a Survey" in a section at the start of the letter.

Personal letters

People generally use a more casual tone and style in personal letters than in business letters. As a result, there are fewer rules governing the form of personal letters than of business letters. But some rules should be followed, especially in sending or receiving invitations. This section describes some of the guidelines for writing formal and informal invitations, as well as thank-you notes and general personal correspondence.

Formal invitations are written in the third person. For example, a wedding invitation might begin, "Mr. and Mrs. Howard Jones request your presence at the marriage of their daughter, Delia Pauline, to . . . ." Most formal invitations are engraved or handwritten. Some business invitations are typed on executive letterheads.

The invitation should begin with the name of the person or group extending the invitation. A description of the event should follow. Identify what the event is—such

Dear Sir or Madam:

On May 7, I mailed your company an order for two Hyper-Space Blasters. I enclosed 50 cents cash plus four Sugar Sprocket candy wrappers. When I opened your package today, I discovered that you had sent me only one Blaster.

Please send me another Hyper-Space Blaster as soon as possible. I'll be watching the mail every day. Thank you.

Sincerely,

Ronnie Johnson

Ronnie Johnson

A complaint letter calls attention to a problem and requests corrective action. The letter should be firm but polite.

Mr. and Mrs. James Clark request the pleasure of Miss Abbott's company at dinner on the evening of April fifth, at half-past seven o'clock.

March twenty-eighth
15 Astor Place

Formal invitation

Miss Abbott accepts with pleasure Mr. and Mrs. Clark's kind invitation for April fifth at half-past seven o'clock.

March thirtieth
157 St. James Street

Acceptance

Miss Abbott regrets that absence from the city prevents her acceptance of the kind invitation of Mr. and Mrs. Clark for April fifth.

Philadelphia, April second.

Declining

as a dinner, wedding, or party—and its date, time, and location. The heading of a formal invitation should be placed below the body of the invitation. The date should appear on the first line and the address should appear on the second line. The date should be spelled out. No signature is used in a formal invitation.

The letters *R.S.V.P.* may appear on the invitation. The letters are an abbreviation for the French phrase *Répondez, s'il vous plaît,* which means *Please reply.* An invitation may also say *Please reply* or *The favor of a reply is requested* instead of R.S.V.P. Any request for a reply should appear in the lower left-hand corner.

35 South 33rd Street
April the fourth

Dear Mrs. James,
Will you and Mr. James dine with us on Tuesday, the fifteenth of April, at eight o'clock?

We shall be very glad if you are able to come.

Very sincerely,
Alice Jones

Informal invitation

Informal invitations are usually handwritten and friendlier in tone than formal invitations. The heading of an informal invitation remains at the top, with the date, unabbreviated, first and the writer's address next. A salutation comes next, ending with a comma. The body of an informal invitation contains the same kind of information that appears on a formal invitation. Some writers list the location, date, and time above each other. For example:

Location: 23 Dumas Avenue
Hampton, NH 03842
Date: June 29, 20—
Time: 6:00 p.m. to 10:00 p.m.
Telephone: (613) 934-6089

The informal invitation may include a complimentary close and signature or an R.S.V.P.

Thank-you notes are brief letters of thanks for a gift, a dinner, a favor, or some other hospitality. Writing a thank-you note shows gratitude and good manners. Make the note sound as if you were talking to your host or hostess in person. Thank-you notes are usually written by hand on a card or on personal stationery.

Other personal letters include pen pal letters and correspondence between family members or friends. These letters follow no particular rules. Their primary purpose is to share news and thoughts with others.

Young people can make friends with others their age in another state, province, or country through pen pal letters. Many organizations and some magazines exist to provide names and addresses of people seeking pen pals. These people exchange letters, become friends, and eventually may meet in person. Girl Scout and Boy Scout groups have pen pal services, or your local library may be able to help. Deborah Dumaine

Related articles in World Book include:

Address, Forms of
Careers (Writing a résumé)
Etiquette
Grammar
Handwriting
Postal Service, United States (table: Postal service abbreviations for states and other areas)
Punctuation
Spelling

Additional resources

Baugh, L. Sue. *How to Write First-Class Letters.* NTC Pub. Group, 1994.
Otfinoski, Steve. *Putting It in Writing.* 1993. Reprint. Scholastic, 1994. Younger readers.

Letters of the alphabet. See Alphabet; and the separate articles on each letter.

Lettuce is a popular vegetable used chiefly in salads. People usually eat it fresh and uncooked. Lettuce forms a part of many weight-control diets because it contains few calories and provides calcium, iron, and vitamin A. Most kinds of lettuce have large, green leaves and grow close to the ground on extremely short stems. Lettuce ranks as an important farm crop in the United States, and home gardeners raise several varieties. Lettuce farming probably began in Persia as early as 550 B.C.

Kinds of lettuce. There are three main kinds of lettuce: (1) *head;* (2) *leaf;* and (3) *cos,* or *romaine.*

Head lettuce has leaves that curl around the plant's center, forming a ball-shaped head. *Crisp head lettuce,* or *iceberg lettuce,* has a tight head and brittle, juicy

leaves. Head lettuce is the major type of lettuce grown commercially in the United States. Widely grown varieties include Great Lakes, Imperial, and Vanguard.

Butterhead lettuce has a looser, more open head and soft, oily leaves. It spoils easily and so is not as popular as crisp head. Varieties of it include Bibb and Boston.

Leaf lettuce forms dense, leafy clumps instead of heads. Gardeners grow more of it than of any other kind. Most leaf lettuce has light green leaves, but a few red varieties have been developed. The waxy, crinkled leaves vary in shape among various types of leaf lettuce. Popular varieties include Black-Seeded Simpson and Grand Rapids.

Cos, or romaine, lettuce grows long and upright and its leaves curl inward. The leaves are tender and can be easily damaged in shipment. For this reason, cos is the least widely grown kind of lettuce even though it is the most nutritious.

Other kinds of lettuce include *celtuce* and *wild lettuce.* Celtuce looks and tastes like a combination of celery and lettuce. Wild lettuce, from which all present-day varieties of the lettuce plant were developed, grows in mild climates throughout the world.

Growing lettuce. Most kinds of commercial lettuce grow well in temperatures between 70 °F (21 °C) and 75 °F (24 °C). Some varieties that were developed for gardeners thrive at just below 80 °F (27 °C). In the Northeastern United States, commercial growers plant lettuce in spring for harvest during the summer. Growers in the Southern and Southwestern states plant in fall or winter for harvest during the spring.

California leads the United States in lettuce production, with about 70 percent of the country's commercial crop. Crisp head lettuce grows nearly the year around in the cool Salinas Valley of California. The other top lettuce-growing states are, in order of importance, Arizona, Florida, Colorado, and New York.

Planting and cultivating. Most commercial lettuce growers plant their crop directly in the field. Some growers in the Northeastern United States plant seedlings that have been raised in greenhouses. Many gardeners also plant seedlings. In some areas, winter lettuce crops may be grown entirely in greenhouses.

Weeding and fertilizing should take place at or just below the surface of the ground, or the plant's shallow root system may be injured. Lettuce requires a steady supply of water and fertilizer.

Harvesting. Workers harvest lettuce by cutting off the heads just above the soil. Then they remove any dead or damaged leaves. Head and cos lettuce are harvested when the leaves are firmest, about 70 to 90 days after seeding, depending on the variety. Leaf lettuce can be harvested whenever the leaves reach the desired size.

Packing and shipping. Lettuce spoils quickly and must be packed, cooled, and shipped immediately after being cut. On most lettuce farms, workers pack and vacuum cool the lettuce in the field. The workers pack the lettuce in cardboard cartons and put the cartons into a special refrigerated truck. In this truck, the temperature of the lettuce drops to just above freezing. On some farms, the lettuce is packed between layers of crushed ice in wooden crates. The crates are then put into refrigerated trucks or railroad cars for shipment to market.

Diseases and insect pests. The chief diseases of lettuce include *bottom rot, downy mildew,* and *lettuce drop.* Crop rotation and chemical treatment of the soil help prevent these diseases. Another disease, *tipburn,* may be caused by too much heat or humidity. Scientists have developed types of lettuce that resist tipburn. These types include Minetto and Fulton.

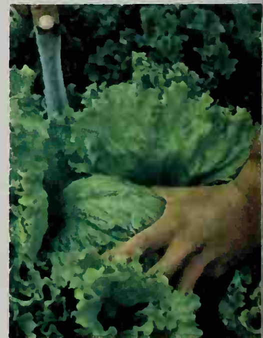
Such insect pests as aphids, cabbage loopers, and cutworms destroy lettuce leaves and stems. However, the majority of these pests can be controlled through the use of insecticides. H. T. Erickson

Scientific classification. Lettuce belongs to the composite family, Compositae. Its scientific name is *Lactuca sativa.* Head lettuce is *L. sativa,* variety *capitata.* Leaf lettuce is variety *crispa,* and cos lettuce is variety *longifolia.*

Leucippus, *loo KIHP uhs,* was a Greek philosopher who lived in the 400's B.C. Leucippus originated the theory of *atomism.* This theory states that matter is composed of fundamental particles, or *atoms.* These particles cannot be further divided. The term *atom* comes from the Greek word *atomos,* meaning *uncuttable.*

Fred Lyon, Rapho Guillumette





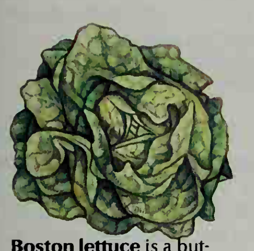
Western Iceberg Lettuce, Inc.

Lettuce harvesting, *left,* begins after the heads become firm. Workers cut the heads, *above,* and pack them in boxes. A truck takes the heads to a cooling tunnel before they are shipped to market.

Kinds of lettuce

Crisp lettuce is the basic ingredient of most salads. The various kinds of lettuce differ in shape, taste, and texture. Several of the most popular kinds are pictured here.

WORLD BOOK illustrations by Carol A. Brozman



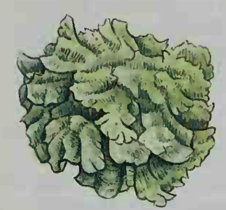
Boston lettuce is a butterhead variety that forms loose, partly folded heads.



Iceberg lettuce, a crisp head lettuce, is available the year around.



Romaine lettuce leaves curl inside one another, forming long rolls.



Leaf lettuce is the easiest kind of lettuce to grow in home gardens.



Bibb lettuce has dark green leaves that grow in small, loose clusters.



Celtuce lettuce combines the flavors of celery and lettuce.

Unlike earlier Greek philosophers, Leucippus believed that *what is* (atoms) and *what is not* (empty space) are both real. He believed that all observable properties of an object result from the movement and collision of atoms in empty space. Leucippus thought that this behavior of atoms was completely determined in advance. "Everything," Leucippus wrote, "comes about for a reason and by necessity."

Little is known of Leucippus's life, and only one fragment of his writings has survived. His ideas, however, have come down to us through the work of his pupil Democritus. S. Marc Cohen

See also **Atomism; Democritus; Materialism.**

Leukemia, *loo KEE mee uh,* is a cancer of the bone marrow, which is the soft, spongy, blood-forming tissue within bones. Bone marrow produces three types of blood cells: (1) white blood cells that fight infections; (2) red blood cells that carry oxygen from the lungs to the rest of the body; and (3) platelets, tiny blood cells that help stop bleeding. In leukemia, large numbers of abnormal white blood cells multiply in an uncontrolled manner in the bone marrow and crowd out normal blood cells. In addition, the abnormal white blood cells do not fight infections.

Symptoms of leukemia include fevers and infections. Fatigue, *anemia* (a lack of functioning red blood cells), and bleeding or bruising due to low platelet count are also among the symptoms of the disease.

Leukemia is classified as *acute* or *chronic,* depending on how quickly it develops. The disease is also classified by the type of white blood cells affected. The most common types of white blood cells are *lymphoid* and *myeloid,* and each kind fights certain infections. When leukemia affects lymphoid cells, it is called *lymphocytic leukemia.* Leukemia that affects myeloid cells is called *myeloid* or *myelogenous* leukemia. Both lymphocytic and myeloid leukemia may be acute or chronic.

Acute leukemias develop extremely quickly. Abnormal, immature white blood cells multiply rapidly, and the number of normal cells decreases sharply. Acute lymphocytic leukemia is the most common leukemia of children. About 70 percent of children with this leukemia can be cured with current treatments.

The most common treatment for acute lymphocytic leukemia is *chemotherapy,* the use of chemicals to kill the cancer cells. Radiation therapy may be combined with chemotherapy to treat this leukemia. Radiation therapy uses high-energy X-rays to kill cancer cells. Another treatment is *bone marrow transplant,* in which the diseased bone marrow is destroyed and replaced with healthy bone marrow from a donor.

All treatments for acute leukemias are intensive and may endanger the patient's life. The use of powerful antibiotics and of blood transfusions has increased the chances of surviving the intensive therapy.

Acute myeloid leukemia usually strikes adults. Chemotherapy is the preferred treatment for this leukemia. Seventy percent of patients receiving chemotherapy enter *remission.* During remission, the blood cells and bone marrow return to normal. Patients are considered cured if they remain in remission for at least two years. However, only 25 percent of patients with acute myeloid leukemia remain in remission and are cured.

Chronic leukemias develop more slowly than acute leukemias. In chronic leukemias, the abnormal white blood cells appear mature and resemble normal white blood cells. In the early stages of the disease, the abnormal cells even function normally. Chronic lymphocytic leukemia is the most common leukemia among adults. The disease may take as long as 10 years to develop. This leukemia typically changes within several years into an acute leukemia that is resistant to most treatments. Chronic myeloid leukemia also occurs primarily in adults.

Cause. The cause of most leukemia is unknown. Possible causes include genetic abnormalities and exposure to radiation or certain chemicals. In patients with chronic myeloid leukemia, sections of two chromosomes have switched places. This switch leads to the production of an enzyme that triggers cell growth. Scientists have created a drug that blocks the action of the enzyme. The drug, marketed as Gleevec, is highly effec-

tive for treating chronic myeloid leukemia. By targeting the abnormality that causes the growth of the leukemia cells, Gleevec kills only leukemia cells. As a result, side effects of the treatment are minimal. Scientists are working to identify all the molecular abnormalities of each type of leukemia so that similar treatments can be developed. Brian J. Druker

See also **Blood** (Blood disorders); **Bone marrow transplant; Chemotherapy.**

Additional resources

Mughal, Tariq I., and Goldman, J. M. *Understanding Leukaemia and Related Cancers.* Blackwell Science, 1999.
Siegel, Dorothy S., and Newton, D. E. *Leukemia.* Watts, 1994.

Leutze, *LOYT suh,* **Emanuel Gottlieb** (1816-1868), gained fame as a painter of American historical subjects. His best-known painting is *Washington Crossing the Delaware* (1851), which he painted in Germany, using the Rhine as a model for the Delaware. In 1860, Congress commissioned him to paint a mural for the United States Capitol, *Westward the Course of Empire Takes Its Way.* Leutze was born on May 24, 1816, at Gmünd, Germany. In 1859, he settled in New York City. Sarah Burns

See also **State, Department of** (picture: Secretary of State William H. Seward).

Levee, *LEHV ee,* is a wide wall built along the banks of rivers to keep them from flooding the land. Levees are made mostly of sandbags and banked-up earth. The name comes from the French word *lever,* which means *to raise.* In the United States, the term is used especially to describe walls, or dikes, along the southern Mississippi River. Irrigation engineers use the term *levee* to describe a small dike or ridge of earth that confines areas of land to be flooded for agricultural purposes.

The first Mississippi River levee was only 3 feet (90 centimeters) high. It was built at New Orleans in 1718 to keep the river from flooding a strip of fertile land. In the 1800's, the seven states south of where the Mississippi meets the Ohio asked the federal government for help to check floods. In 1882, the year of a great Mississippi flood, the government set aside $1,300,000 for the improvement of the river. Part of the money was used for making levees. Since then, the federal and state governments have spent millions of dollars for the building and repairing of levees.

The earth embankments along the Mississippi River are 15 to 30 feet (4.6 to 9.1 meters) high. They are 8 feet (2.4 meters) wide on top and over 100 feet (30 meters) wide at the base. About 2,200 miles (3,500 kilometers) of levees have been built along the Mississippi River, but they still do not fully control the overflow. Some of these levees are being improved to provide greater flood control. Some authorities object to the building of levees that enclose a river so much that the water is high above the surrounding countryside. This makes floods even more dangerous when they occur. If a levee were to break under these circumstances, a wall of water would rush across the countryside, smashing everything in its way. Experts who oppose high levees believe regulating floods by headwater control is better than trying to regulate them with levees. Larry W. Mays

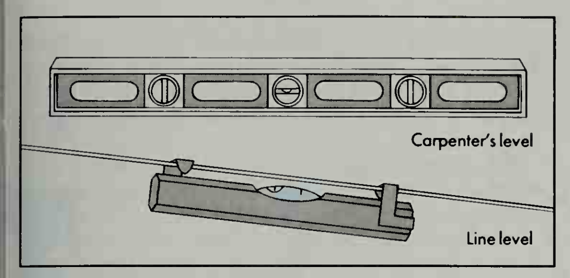
See also **Flood; Jetty; Mississippi River.**

Level is an instrument used by carpenters, plumbers, and others to determine if a surface is perfectly horizontal. Most levels consist of a small, arched glass tube set in a bar of wood or metal. The tube is marked at its center, which is its highest point. It contains alcohol or another liquid and a bubble of air. When a level is placed lengthwise on a perfectly horizontal surface, the bubble rests at the center of the tube. If the surface that is being

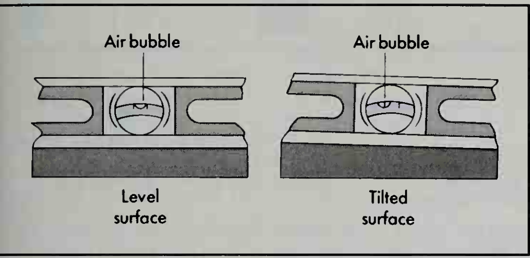


Oil painting on canvas (1851); Metropolitan Museum of Art, New York City, gift of John Steward Kennedy, 1897

An Emanuel Leutze painting called *Washington Crossing the Delaware* is the best known of this German artist's carefully composed and melodramatic scenes from American history.



Kinds of levels include the *carpenter's level,* which checks horizontal or vertical surfaces, and the *line level,* which is hung along a tight string for leveling long spans.



WORLD BOOK illustrations by Zorica Dabich

How a level works is shown above. If the surface is level, the air bubble comes to rest at the center of the tube. If the surface is tilted, the bubble is off center.

checked is tilted, the bubble rises to the high end of the tube. Some levels have additional tubes that are set at right angles to the length of the tool. These tubes enable workers to tell if a surface is *plumb* (vertical).

Levels generally derive their names from their use. For example, *mason's levels* are used by masons in building walls of brick or stone. These levels measure 4 feet (1.2 meters) long and are the longest levels. A *carpenter's level* is similar to a mason's level, but is commonly about 2 feet (60 centimeters) long. *Line levels,* sometimes called *string levels,* are hung along a tight line or string. Builders use them in laying foundations and in performing other work that involves leveling long spans. Line levels, which are about 3 inches (8 centimeters) long, are the shortest levels.

A *builder's level* contains a telescope and a leveling tube mounted on a *tripod* (three-legged stand). It is used to measure horizontal angles. A similar level, called a *transit,* measures vertical and horizontal angles. These levels enable builders, engineers, and surveyors to measure angles and level buildings with great accuracy.

Alva H. Jared

Levellers were political radicals in England during the mid-1600's who believed that all people deserved a voice in government. They expressed many democratic ideas that developed in England and America during the 1700's and 1800's.

The Levellers had strong support among small farmers, artisans, and craftworkers, and they threatened the political power of the aristocratic landowners. Many soldiers who fought in the parliamentary army during the English Civil War in the 1640's were Levellers. But the Levellers found the new parliamentary government almost as aristocratic as the monarchy it had replaced. Leveller influence declined after an army mutiny was crushed in 1649.

Lacey Baldwin Smith

Lever, *LEHV uhr* or *LEE vuhr,* is one of the six simple machines for performing work. It consists of a rod or bar that rests and turns on a support called a *fulcrum.* A force of effort is applied at one end of the rod to lift a load placed at the other end. The distance between the fulcrum and the load is the *load arm.* The distance from the fulcrum to the applied force is the *effort arm.* A lever can help lift a weight with less effort. Prying something loose with a crowbar is using a lever. Some machines, such as a catapult, use a lever to hurl objects.

Classes of levers

First-class levers have the fulcrum placed between the load and the effort, as in the seesaw, crowbar, and balance scale. If the two arms of the lever are of equal length, the effort must be equal to the load. To lift 10 pounds, an effort of 10 pounds must be used. If the effort arm is longer than the load arm, as in the crowbar, the effort travels farther and is less than the load. A pair of scissors is a *double lever* of the first class.

Second-class levers have the load between the effort and the fulcrum. A wheelbarrow is a second-class lever. The axle of the wheel is the fulcrum, the handles take the effort, and the load is placed between them. The effort travels a greater distance and is less than the load. A nutcracker is a double lever of this class.

Third-class levers have the effort placed between the load and the fulcrum. The effort always travels a shorter distance and must be greater than the load. The forearm is a third-class lever. The hand holding the weight is lifted by the biceps muscle of the upper arm which is attached to the forearm near the elbow. The elbow joint is the fulcrum.

Compound levers combine two or more levers, usually to decrease the effort. By applying the principle of the compound lever, a person could use the weight of one hand to balance a load weighing a ton.

Law of equilibrium

A lever is in equilibrium when the effort and the load balance each other. The law of equilibrium is:

The effort multiplied by the length of the effort arm equals the load multiplied by the length of the load arm.

Let L be the load, E the effort, e the effort arm, and w the load arm. The law of equilibrium may be stated in a mathematical formula: L is to e as E is to w, or

$$E \times e = L \times w$$

To see how the formula works, imagine two children sitting on a seesaw. One child weighs 40 kilograms and sits 1.5 meters from the fulcrum. Where must the other child sit to balance the seesaw if the other child weighs 30 kilograms? Let the first child equal the load, L, and the second child the effort, E.

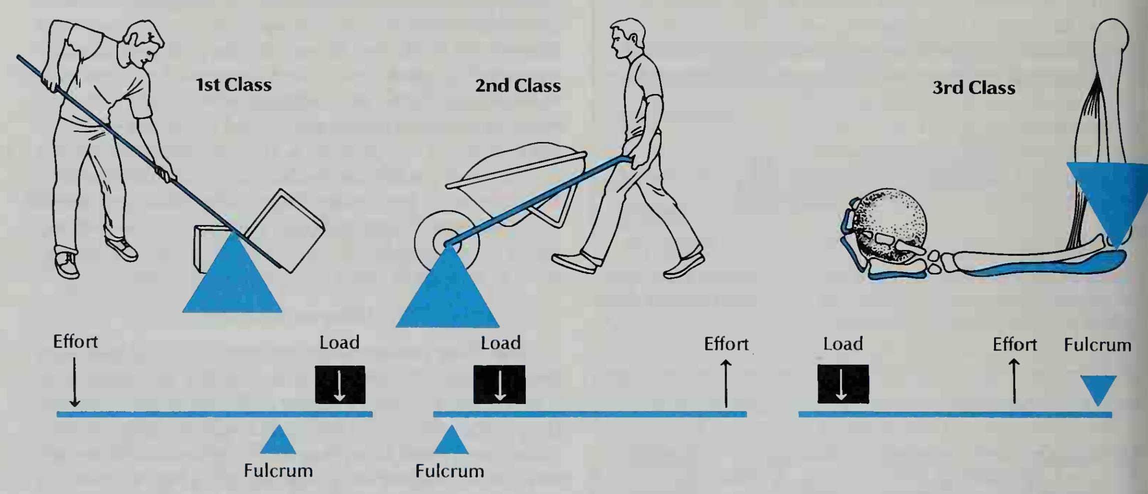
$$30 \text{ kilograms} \times e = 40 \text{ kilograms} \times 1.5 \text{ meters}$$

$$e = \frac{60 \text{ kilogram-meters}}{30 \text{ kilograms}}$$

$$e = 2 \text{ meters}$$

Another example of a first-class lever is that of a person lifting a 300-pound stone with a 6-foot crowbar. The stone is 1 foot from the fulcrum. The person then pushes down on the crowbar 5 feet from the fulcrum. So, $E \times 5$

Classes of levers



WORLD BOOK illustrations by Bill and Judie Anderson

In a 1st class lever, the fulcrum is between the effort and the load.

In a 2nd class lever, the load is between the fulcrum and the effort.

In a 3rd class lever, the effort is between the fulcrum and the load.

feet=300 pound×1 foot; or E=60 pounds, the force needed to balance the stone.

This law of equilibrium is true for all classes of levers. A force multiplied by its lever arm is called a *moment of force,* or *torque.* The law of levers may be stated simply by saying that the moment of the lifting force must equal the moment of the force due to the load.

The *mechanical advantage* of a lever tells how many pounds of load can be moved by each pound of effort. It can be calculated by dividing the load by the effort or the length of the effort arm by the length of the load arm. In the crowbar example above, the mechanical advantage is 5, that is, 300 pounds divided by 60 pounds, or 5 feet divided by 1 foot. James D. Chalupnik

See also **Archimedes; Wheel and axle.**

Lévesque, *lay VEHK,* **René,** *reh NAY* (1922-1987), served as premier of the Canadian province of Quebec from 1976 to 1985. He was once a leader of the Quebec separatist movement. The separatist movement aims to make Quebec an independent French-speaking nation. But in 1985, Lévesque's government made economic development, instead of separatism, its main goal for Quebec.

Lévesque was born in New Carlisle, Quebec. From 1956 to 1959, he hosted "Point de Mire" (Point of View), a public affairs television program. From 1960 to 1970, Lévesque served in Quebec's legislature and held several cabinet posts.

Lévesque founded a separatist group in 1967 and merged it with a similar group in 1968 to form the Parti Québécois (Quebec Party), a political party. At that time, Lévesque believed that only independence could give Quebec control of its economy and end what he considered job and wage discrimination against French-speaking Quebecers. English-speaking Canadians and Americans exercised great control over Quebec's economy, and nearly all the province's best-paying jobs required a knowledge of English.

In 1976, the Parti Québécois won control of Quebec's legislature. Lévesque became premier and announced that he would seek independence for the province. In 1980, however, the province's voters rejected a proposal that would have given Lévesque the authority to negotiate with the Canadian government for independence. Lévesque's emphasis on economic development in 1985 divided the Parti Québécois, and he resigned as party chief later that year. Laurier L. LaPierre

See also **Canada, History of** (The separatist threat); **Parti Québécois.**

Lévi-Strauss, *LAY vee strohs,* **Claude** (1908-), a French anthropologist, developed *structuralism* in the study of human culture. Structuralism is a method of analysis that examines the structures that underlie relationships between things, rather than simply the things themselves.

Lévi-Strauss derived the structural approach from *structural linguistics,* a science that studies languages through the structure of their sounds and words. He used structuralism to study family relationships, the myths of North and South American Indians, and even cooking methods. According to Lévi-Strauss, myths throughout the world are transformations of one another. The myths of different cultures may appear to be different. But if the myths have the same structure, they may actually be saying the same thing.

Lévi-Strauss was born in Brussels, Belgium, and studied at the University of Paris. His books include *The Elementary Structures of Kinship* (1949), *The Savage Mind* (1962), and a four-volume study of myth, *Mythologiques* (1964-1971). Igor Kopytoff

See also **Mythology** (Lévi-Strauss's theory).

Levine, *luh VEEN,* **Jack** (1915-), is an American artist who has won fame as a critic of life in the United States. Many of his paintings deal with political corruption. Other works portray the difficult lives of workers and the poor. Levine has also painted many pictures with Old Testament and Jewish themes.

Levine was born in Boston. In 1935, he worked for the Federal Art Project, a government program under the Works Progress Administration. Pamela A. Ivinski

Levine, *leh VYN,* **James** (1943-), is an American conductor and pianist. He became principal conductor of the Metropolitan Opera in New York City in 1973 and the company's music director in 1976. He became artistic director in 1986.

Levine was born in Cincinnati and began piano lessons at the age of 4. He made his debut as a soloist at the age of 10, performing with the Cincinnati Symphony Orchestra. From 1964 to 1970, he was apprentice conductor and then assistant conductor of the Cleveland Orchestra. Levine made his Metropolitan Opera debut in 1971. He served as music director of the summer Ravinia Festival near Chicago from 1973 to 1993. He also conducts at the annual Bayreuth Festival in Germany and the Salzburg Festival in Austria. He has been a guest conductor of the Berlin Philharmonic Orchestra and the London Symphony Orchestra. He also conducts regularly at the Vienna State Opera. John H. Baron

Levinson, Barry (1942-), is an American motion-picture director and screenwriter. Levinson favors offbeat material in his films. His movies feature crisp, often funny dialogue and display a sensitivity to the warm humanity of the characters. Levinson has an understated directorial style that rarely calls attention to itself.

Levinson was born in Baltimore. He began his career as a comedy writer for television and then became a screenwriter. He made his debut as a director with *Diner* (1982), a partly autobiographical story set in Baltimore in the late 1950's. Levinson wrote and directed three other films in his "Baltimore Series"—*Tin Men* (1987), *Avalon* (1990), and *Liberty Heights* (1999). Levinson alternated these personal films with more commercial assignments. *The Natural* (1984) is a baseball movie. *Good Morning, Vietnam* (1987) is set in the mid-1960's, during the period of U.S. involvement in the Vietnam War. Levinson won the 1989 Academy Award for his direction of *Rain Man* (1988), a drama about two brothers. Levinson's other films include *Young Sherlock Holmes* (1985), *Bugsy* (1991), *Toys* (1992), *Jimmy Hollywood* (1994), *Sleepers* (1996), and *Wag the Dog* (1997). Louis Giannetti



Oil painting on canvas (1953); collection of the Whitney Museum of American Art, New York City

Jack Levine's *Gangster Funeral* shows the distorted forms and rich color typical of the artist's style. Levine became known for his satirical treatment of various aspects of American life.

Levites, *LEE vyts,* were a tribe of ancient Israel. According to the Bible, all Levites were descendants of Jacob's son Levi. During the Israelites' journey through the wilderness from Egypt to Canaan (later called Palestine), the Levites were given charge of the Tabernacle (see **Tabernacle**). Later, they cared for the temple in Jerusalem. Levites from the family of Aaron served as priests. When Canaan was divided among the 12 tribes of Israel, no section was given to the Levites. But they received 48 scattered towns and were supported by a *tithe* (tax) levied on the other 11 tribes. H. Darrell Lance

Leviticus, *leh VIHT uh kuhs,* is the third book of the Hebrew Bible, or Old Testament. Its name comes from its title in the Latin translation of the Bible, which calls it *Book of Levis.* The title refers to the tribe of Levi, from which the priests of the people of Israel were descended. The book is composed almost entirely of priestly regulations. However, many of these rules concern nonreligious life and thus show how all aspects of life were considered part of religious behavior. See **Pentateuch.**

Leviticus has four main parts. The first, *Sacrificial Laws* (1-7), lists the different kinds of offerings the people made. The second, *The Consecration of Aaron* (8-10), describes the High Priest taking office. The third, *The Purity Laws* (11-16), deals with individual purity and national atonement. The fourth, *The Holiness Laws* (17-27), includes a special section called the Holiness Code (19-25). The code calls for people to obey God's law and to become a holy people in imitation of God, who is the supreme example of holiness. Carol L. Meyers

Levitt, William Jaird (1907-1994), was a pioneer in the development of large-scale suburbs in the United States. Near the end of World War II (1939-1945), Levitt saw a tremendous need for affordable housing for returning veterans. He used mass-production techniques to build inexpensive single-family houses on a 1,200-acre (486-hectare) tract of land on Long Island in New York City. From 1947 to 1951, the firm of Levitt & Sons, Inc., constructed 17,450 homes on the land parcel, which came to be known as Levittown. See **Levittown.**

Levitt developed two other Levittowns, one (now called Willingboro) in New Jersey and the other in Pennsylvania. His planning and building methods have been repeated in the construction of many suburbs of the United States. Levitt was born in the Brooklyn section of New York City. Anthony James Catanese

Levittown, New York (pop. 53,067), is an unincorporated residential community on Long Island (see **New York** [political map]). Levittown developed from a housing project begun in 1946 for veterans of World War II. The firm of Levitt & Sons, Inc., began the housing project in an area that consisted of potato fields and truck farms. Thousands of homes were constructed, using pre-fabricated units and assembly-line techniques. The homes looked much alike except for their color. Levittown grew from a population of about 450 in 1946 to 60,000 by the late 1950's as a result of a postwar housing boom.

Careful planning of the area has resulted in many advantages. Levittown has no slums, and it has several swimming pools, community centers, and schools. John Kenneth White

Lewin, Kurt (1890-1947), was a leading child and social psychologist. He studied the effect of authoritarian and democratic behavior on groups, and the forces that

change social groups. Lewin taught at Stanford, Cornell, and Iowa universities and directed the Research Center for group dynamics at the Massachusetts Institute of Technology. He was born in Mogilno, Germany (now in Poland). He came to the United States in 1932. See also **Sensitivity training**. Claude A. Eggertsen

Lewis, Sir Arthur (1915-1991), a British economist, became the first black person to win the Nobel Prize in economics. He and Theodore W. Schultz of the United States shared the award in 1979 for their research on the economic problems of developing nations.

Lewis helped shape the field of development economics with his book *Theory of Economic Growth* (1955). Lewis's economic theories emphasize the relationship between traditional agriculture and modern industries in developing nations and between developing countries and developed countries.

William Arthur Lewis was born in St. Lucia in the West Indies. He began teaching at the London School of Economics in 1938 and earned a Ph.D. degree there in 1940. From 1963 to 1985, he taught at Princeton University. Lewis held advisory and other official posts in the United Kingdom and Ghana, and at the United Nations and the World Bank. In 1970, he became the first president of the Caribbean Development Bank. Lewis was knighted in 1963. John P. Lewis

Lewis, C. S. (1898-1963), a British author, wrote more than 30 books, including children's stories, science fiction, and literary and religious works. Most of his writings teach moral lessons. After years of experiencing religious doubt, he converted to Christianity in the 1930's. Lewis then became a leading defender of Christianity.

Lewis taught medieval literature at Oxford University from 1925 to 1954 and at Cambridge University from 1954 to 1963. In his first important work of literary criticism, *The Allegory of Love* (1936), Lewis examined the theme of love in medieval literature. His first science-fiction novel, *Out of the Silent Planet* (1938), tells of three scientists who travel to Mars and find strange creatures living there. Lewis's most popular religious work, *The Screwtape Letters* (1942), is a witty satire in which an old devil advises a young devil. His other books on religion include *The Problem of Pain* (1940), *The Abolition of Man* (1943), and *Mere Christianity* (1952), all written in the same suave, witty, and colorful style that characterizes his fiction and his literary criticism.

From 1950 to 1956, Lewis wrote a series of seven children's books called *The Chronicles of Narnia.* These books combine myth and fantasy with moral principles.

Clive Staples Lewis was born in Belfast, Northern Ireland. In an autobiography of his early life, *Surprised by Joy* (1955), Lewis discussed the development of his religious beliefs. Garrett Stewart

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Lewis, Carl (1961-), an American athlete, ranks among the greatest sprinters and long jumpers in track and field history. Lewis twice set a world record in the 100-meter dash and ran the *anchor* (final) leg on eight world record relay teams. He competed in the Olympic Games in 1984, 1988, 1992, and 1996. He won nine gold medals, which tied for the highest total in Olympic track



AP/Wide World

Carl Lewis is a track and field star who won nine gold medals in Olympic Games competitions. Lewis anchored the U.S. 400-meter relay team, *shown here,* which set a world record in the 1992 Olympics. He also won the Olympic long jump four times.

and field history. He is the only man to win the 100-meter dash twice and the only man to repeat as long jump champion, winning four times. From 1981 to 1991, Lewis won 65 consecutive long jump competitions.

Lewis was born in Birmingham, Alabama. He starred in track and field at the University of Houston in 1980 and 1981, when he began competing for the Santa Monica Track Club. Lewis discussed his career in *Inside Track: My Professional Life in Amateur Track and Field* (1990, rev. ed., 1992). In 1997, Lewis announced his retirement from track and field competition. Michael Takaha

Lewis, Francis (1713-1802), a New York signer of the Declaration of Independence, spent most of his fortune in support of the patriot cause during the Revolutionary War in America. From 1775 to 1779, he served as a delegate to the Continental Congress. He distinguished himself by his committee work, especially on the problem of army supply. Lewis was born in Llandaff, Wales. He came to America in 1738 and became a wealthy merchant. Jack N. Rakove

Lewis, John Aaron (1920-2001), was an American pianist and composer. In 1952, he formed the Modern Jazz Quartet, the most durable combo in jazz history. He served as its pianist and music director until the group disbanded in 1995 following the death of drummer Connie Kay. Lewis pioneered in the development of *third stream music,* a blend of jazz and classical music. He composed music for jazz ensembles, orchestras, films, and the stage.

Lewis was born in La Grange, Illinois, and studied music and anthropology at the University of New Mexico. He went to New York in 1945 and worked in Dizzy Gillespie's big band. From 1958 to 1964, Lewis served as musical director for the Monterey Jazz Festival. Lewis's best-known compositions include *Django, Concorde, Afternoon in Paris,* and *Two Bass Hit.* Gary Giddins

Lewis, John L. (1880-1969), was a powerful American labor leader. He served as president of the United Mine Workers of America (UMW) from 1920 to 1960.

Lewis's career was marked by bitter strikes and sharp

conflicts with union opponents. He challenged the craft organization of the American Federation of Labor (AFL) by forming the Committee for Industrial Organization (CIO) in 1935. Unions that joined the CIO were suspended by the AFL Executive Council in 1936 and ousted in 1938. In 1938, the CIO formed its own federation and changed its name to the Congress of Industrial Organizations. Under Lewis, the CIO organized strong industrial unions in the mass-production industries. Lewis took the UMW out of the CIO in 1942. The UMW rejoined the AFL in 1946, but withdrew again in 1947. Lewis's last great achievement for the UMW was the adoption of the union's health and retirement programs. John Llewellyn Lewis was born in Lucas, Iowa. Jack Barbash

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Zieger, Robert H. *John L. Lewis.* Twayne, 1988.

Lewis, Meriwether (1774-1809), was an American explorer. With William Clark, he led the famous Lewis and Clark expedition, which explored the Louisiana Territory and the Pacific Northwest from 1804 to 1806.

In 1801, Lewis, a captain in the United States Army, became private secretary to U.S. President Thomas Jefferson. Under Jefferson's direction, Lewis made plans to explore a route west to the Pacific coast of North America. Lewis invited Clark to join the expedition, and the two men privately agreed to lead it jointly.

The expedition started up the Missouri River in May 1804 from a camp near St. Louis. By late fall, the explorers had reached what is now North Dakota, and they spent the winter there. The following spring, they continued along the Missouri and, in late summer, crossed the Rocky Mountains. The explorers then followed the Clearwater, Snake, and Columbia rivers to the Pacific coast, which they reached in November 1805. The party spent the winter on the coast of what is now Oregon and began the trip home in March 1806. The party returned along nearly the same route by which they had come, reaching St. Louis in September 1806.

Lewis served as the party's naturalist and, on the expedition, collected plant, animal, and mineral specimens. As a reward for his service, Jefferson named Lewis governor of the Louisiana Territory in 1807. In 1809, Lewis probably committed suicide. Personal and professional problems may have driven him to this act. But some people believe that he was murdered.

Lewis was born in Albemarle County, Virginia. He joined the U.S. Army in 1794 and rose to the rank of captain in 1800. Gary E. Moulton

See also Clark, William; Lewis and Clark expedition.

Lewis, Sinclair (1885-1951), gained international fame for his novels attacking the weaknesses he saw in American society. In 1930, Lewis became the first American author to win the Nobel Prize for literature.

Harry Sinclair Lewis was born on Feb. 7, 1885, in Sauk Centre, Minnesota. At the age of 21, he lived briefly at Helicon Hall, a socialist community in New Jersey founded by writer Upton Sinclair. Lewis graduated from Yale University in 1908. In 1914, while working as a newspaperman, he published his first novel, *Our Mr. Wrenn.* The book is a gently satiric account of a meek New York clerk traveling in Europe.


Eric Schaal, Pix
Sinclair Lewis

Lewis wrote four more novels and achieved only modest success. But *Main Street* (1920) caused a sensation and brought him immediate fame. The book is a withering satire on the dullness and lack of culture that exist in a "typical" American small town, and the narrow-mindedness and self-satisfaction of its inhabitants. Written in minute detail, *Main Street* chronicles the fruitless efforts of the heroine Carol Kennicott to awaken and improve her town. Lewis based the novel on Sauk Centre, renaming it "Gopher Prairie."

Babbitt (1922) focuses even more effectively Lewis's idea of a "typical" small city businessman, George F. Babbitt. The novel describes the futile attempt of its central character to break loose from the confining life of a "solid American citizen" —a middle-class, middle-aged realtor, civic booster, and club joiner. Possibly no two works of literature did more to make Americans aware of the limitations of their national life and culture than did *Main Street* and *Babbitt.*

With a sharp, satiric eye and a superb gift for mimicry, Lewis continued to examine other aspects of what he considered national inadequacy. *Arrowsmith* (1925) describes the frustrations of an idealistic young doctor in conflict with corruption, jealousy, meanness, and prejudice. The novel won the 1926 Pulitzer Prize, which Lewis declined because he felt that it was not awarded for literary merit but for the best presentation of "wholesome" American life. *Elmer Gantry* (1927) satirizes religious hypocrisy and bigotry in the Midwest.

In 1928, Lewis married Dorothy Thompson (1894-1961), who was a famous foreign correspondent and newspaper columnist. They divorced in 1942.

Dodsworth (1929) was perhaps the last of Lewis's best works. The novel contrasts American with European life while relating the marriage difficulties of a prosperous American businessman on a European tour.

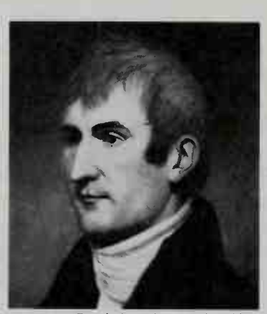
Lewis's later novels were primarily shallow photographic realism. Critics now consider Lewis less a truly creative artist than an extraordinarily accomplished observer with a vivid reportorial style. Lewis died lonely and unhappy in Italy in 1951. Samuel Chase Coale

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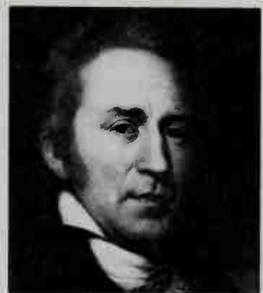
Lewis and Clark expedition was an early exploration of the vast wilderness of what is now the northwestern United States. The expedition was sponsored by the U.S. government and led by U.S. Army officers Meriwether Lewis and William Clark. The expedition began near St. Louis, Missouri, in May 1804 and returned to that city in September 1806.

Lewis and Clark traveled a total of about 8,000 miles (12,800 kilometers) on the expedition. Starting from a camp near St. Louis, they journeyed up the Missouri



Detail of an oil portrait (1807) by Charles Willson Peale; Independence National Historical Park Collection, Philadelphia

Meriwether Lewis



Detail of an oil portrait (1810) by Charles Willson Peale; Independence National Historical Park Collection, Philadelphia

William Clark

River, across the Rocky Mountains, and along the Columbia and other rivers to the Pacific coast. They returned to St. Louis with maps of their route and the surrounding regions; specimens and descriptions of plant, animal, and mineral resources; and information about the native peoples of the West. The success of the expedition enabled the United States to claim the Oregon region, which included what are now the states of Oregon, Washington, and Idaho.

Jefferson's plans. Soon after Thomas Jefferson became U.S. President in 1801, he began to plan an expedition to chart a route through the Louisiana Territory and the Oregon region. He believed that a route to the Pacific coast along the Missouri and Columbia rivers could be part of a land-and-water passage between the Atlantic and Pacific oceans. The President's plan included gathering scientific information about the regions and establishing communication with the Indians who lived in them. After the United States bought the Louisiana Territory from France in 1803, the expedition received the additional tasks of tracing the boundaries of the territory and laying U.S. claims to the Oregon region.

Jefferson chose Meriwether Lewis to lead the expedition. Lewis was a U.S. Army captain and Jefferson's private secretary. Lewis, in turn, selected William Clark, a former U.S. Army officer, to join him. Lewis had served under Clark in the Army. Clark had resigned from the Army in 1796 but reenlisted in 1803 to join the expedition. When he reenlisted, he received the rank of lieutenant, which was below that of Lewis. But the two men privately agreed to lead the expedition jointly, and on the expedition Clark was always addressed as captain. Both men had wilderness experience and had served in Army campaigns against Indians. In addition, Clark had considerable mapmaking skills, and Lewis had some training in the study of animals and plants.

Preparation. During the summer of 1803, Lewis spent time studying in Philadelphia. He learned how to classify plants and animals and how to determine geographical position by observing the stars. He then went to Pittsburgh, Pa., and, in late August, left the city in a large flat-bottomed boat called a *keelboat.* Near Louisville, Ky., he was joined by Clark, who had been recruiting men from nearby Army posts. For the expedition, the explorers chose skilled woodsmen and hunters who were accustomed to manual labor and military discipline. Most of the men were soldiers.

In December 1803, the party established winter quarters at Camp Dubois (Camp Wood), across the Mississippi River from St. Louis. At the camp, Lewis and Clark trained their men and learned from fur traders and travelers about the regions the party would explore.

Up the Missouri. On May 14, 1804, the expedition set out from Camp Dubois in the keelboat and two *pirogues* (dugout canoes). At first, the expedition consisted of about 50 men. Many were French boatmen temporarily hired to move the heavy keelboat and other craft against the Missouri's swift current. The men



WORLD BOOK map

The Lewis and Clark expedition left a camp near St. Louis in 1804, journeyed up the Missouri River, and crossed the Rocky Mountains. The explorers reached the Pacific coast in 1805. They returned to St. Louis in 1806 with valuable information about the new frontier.



The explorers obtained horses, supplies, and valuable information from Indians they met on their journey. This engraving shows Clark, *far right,* and Lewis, *second from right,* talking with friendly Indians they encountered while traveling north along the Missouri River.

Engraving (1811); Granger Collection

moved the keelboat by pushing poles against the river bottom or by pulling the boat with ropes from shore. The keelboat carried a large amount of supplies, including food, medicine, scientific instruments, weapons, and presents for the Indians.

As Lewis and Clark traveled up the Missouri, they were amazed at the beauty of the land and its abundant wildlife. In September, the explorers had a tense encounter with Sioux Indians. After the explorers had talked and exchanged gifts with them, the Sioux refused to allow Clark to return to the boat. The Indians let him go only after they saw that the soldiers in the party were preparing to fight. Other meetings with Indians were friendly. Often, Indians helped the men by describing the way ahead and by providing food.

In October, the expedition reached the villages of the Mandan and Hidatsa Indians in what is now North Dakota. The group established its winter camp, Fort Mandan, near the villages. During the winter, a French-Canadian trader named Toussaint Charbonneau and his wife, Sacagawea, a Shoshone Indian, joined the expedition. Sacagawea became an interpreter. At the winter camp, Lewis and Clark brought their diaries and maps up to date and wrote about the Indians.

West to the Rockies. The journey resumed on April 7, 1805. The party that continued west consisted of 33 people. They traveled in the two pirogues and six newly built canoes. The others returned to St. Louis with the keelboat, which was loaded with animal, plant, and mineral specimens; maps; and reports for Jefferson.

As Lewis and Clark traveled west into what is now Montana, the terrain became increasingly dry, treeless, and rugged. In early June, the party spent nearly a week where the Marias River joins the Missouri, trying to decide which of the two streams was the main river. The explorers made the right choice and soon afterward arrived at the Great Falls of the Missouri. They skirted the falls with much difficulty, having to carry the boats and supplies overland for 18 miles (29 kilometers).

As they approached the mountains, the explorers hoped to meet friendly Indians who would provide horses and information to guide the party through the region. Luckily, in mid-August, they met a band of Shoshone Indians whose chief was Sacagawea's brother. The explorers traded for horses and supplies, obtained an Indian guide, and began their passage through the Bitterroot Mountain Range. This range rises along what is now the Idaho-Montana border.

Crossing the mountains in Idaho was the most difficult part of the journey up to that time. The explorers had to lead their horses along rocky, narrow mountain paths. Some horses lost their footing and fell to their death, and precious supplies and equipment were lost. As winter set in, there were fewer and fewer wild animals to kill for food. The explorers went hungry until they finally killed and ate some of their pack horses.

As the explorers came out of the mountains, they met the helpful Nez Perce Indians and traded for fresh supplies. Near the present-day Idaho-Washington border, the explorers built canoes, which they used in traveling down the Clearwater, Snake, and Columbia rivers. On the rivers, they faced treacherous falls and rapids and met new Indian peoples. In November 1805, the explorers reached the Pacific coast. They built Fort Clatsop near present-day Astoria, Ore. They spent the winter at the fort and prepared for their return to St. Louis.

The homeward journey began on March 23, 1806. Lewis and Clark decided to split the expedition into two groups on part of the return trip. Lewis would lead one group over a new, shorter route through the mountains, and Clark and the other group would explore the Yellowstone River. The expedition reached the ridge of the Bitterroot Range in June and then divided into the two groups at a spot the explorers called Traveler's Rest. Lewis and his group reached the Missouri River by the new, shorter route and then set out to examine the Marias River. Along the Marias, Lewis' party had a brief fight with some Blackfeet Indians who tried to steal their guns and horses. The explorers escaped unharmed, but two Indians were killed. Clark's group reached the Yellowstone River by a new route. At the Yellowstone, they built canoes and followed the river to its junction with the Missouri. In August, the two groups reunited on the Missouri, below the mouth of the Yellowstone. They then returned to St. Louis, arriving on Sept. 23, 1806, to the welcoming cheers of the city's people.

Results of the expedition. The most important result of the expedition was that it enabled the United States to claim the Oregon region. This claim helped make possible the great pioneer movement that settled

the West in the mid-1800's. The explorers also established peaceful contact with most of the Indian tribes they met. They collected a variety of Indian goods and gathered information on Indian languages and culture.

Lewis and Clark's journals of the expedition describe the natural resources and native peoples of the West and contain information on many scientific matters. They were first published in an edited version in 1814 and in their entirety in 1905. Gary E. Moulton

See also **Clark, William; Colter, John; Lewis, Meriwether; Sacagawea.**

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Lewiston (pop. 35,690) is the second largest city in Maine. Only Portland has more people. Lewiston lies on the east bank of the Androscoggin River, across from Auburn (see **Maine** [political map]). These two cities form a metropolitan area that has 90,830 people.

Lewiston has light manufacturing industries, and it is a regional center for education and health care. The city has two large hospital complexes. It is the home of Bates College, the Central Maine Medical Center School of Nursing, and the Lewiston-Auburn College of the University of Southern Maine. A canal fed by the Androscoggin River runs through downtown Lewiston. Several large brick buildings stand along the canal. They served as textile mills from the mid-1800's to the mid-1900's but have been redeveloped into offices.

Lewiston was first settled in 1770. A number of Irish people moved there in the 1840's and 1850's to help dig canals and build the textile mills. Lewiston became a city in 1861. Many French Canadians settled there after the American Civil War ended in 1865 to work in the mills. Lewiston has a mayor-council government.

Rex H. Rhoades

Lexington, Kentucky (pop. 260,512; met. area pop. 479,198), is one of the nation's chief trading centers for tobacco. The Lexington area also is a leading market for race horses. Lexington passed Louisville in population in the 1990's and now ranks as the state's largest city. For Lexington's location, see **Kentucky** (political map).

Lexington was founded in 1775. Eight pioneers were building the first cabin on the site when they heard about the opening battle of the Revolutionary War in America. They named the settlement for the battle, which was fought in Lexington, Massachusetts.

Description. Lexington is the county seat of Fayette County. Race horses and burley tobacco are raised nearby. The grass and water of the area around Lexington are rich in minerals that give horses strong bones and muscles. Auction markets in the area handle hundreds of standardbred and thoroughbred horses every year and sell millions of pounds or kilograms of tobacco.

The Lexington metropolitan area has about 140 industrial plants. Their products include automobile parts, computer printers, fabricated metal goods, printed materials, processed foods, and typewriters. Automobiles are manufactured in nearby Georgetown.

Lexington is the home of the University of Kentucky and Transylvania University. Transylvania, chartered in 1780, was the first college west of the Allegheny Mountains. Lexington's museums include Ashland, the home of the famous American statesman Henry Clay; and the International Museum of the Horse.

History. Shawnee Indians hunted in what is now the Lexington area when whites first settled there in 1775. The pioneers abandoned Lexington in 1776 but settled there permanently in 1779. Lexington served as the temporary state capital in 1792.

By the early 1800's, horse farms had spread across the rolling meadows of the area. Lexington was incorporated as a city in 1832. Tobacco became important after the 1860's, when growers developed a variety of the plant especially suited to the soil and climate of the area.

The Lexington area began to grow rapidly as a manufacturing center during the 1950's. In 1974, the city combined its government with that of Fayette County. The area became known as Lexington-Fayette Urban County. Lexington Center, which includes a sports arena, a convention hall, a hotel, and stores, opened in 1976. The automobile manufacturing plant in Georgetown, near Lexington, began operations in 1988. In 1998, Hamburg Place, a large shopping center, opened near the intersection of Interstate Highways 75 and 64. David M. Reed

For the monthly weather in Lexington, see **Kentucky** (Climate). See also **Kentucky** (pictures).

Lexington, Battle of. See **Revolutionary War in America** (Lexington and Concord).

Leyden. See **Leiden.**

Leyden jar, *LY duhn,* was one of the first devices used to store an electric charge. It was invented in Leiden (sometimes spelled Leyden), the Netherlands, in 1746.

A Leyden jar is a glass jar that is sealed with a cork. Sheets of metal foil cover about half of the inside and outside of the jar. The foil conducts electric current, but the glass does not. A brass rod is inserted through the cork and brought in contact with the foil in the jar.

When the rod is linked to a source of electric energy, current travels through it and charges the inner foil. Current cannot pass through the glass, but the outer foil becomes charged by *induction* if it is properly grounded (see **Induction, Electric**).

The outer foil has a charge opposite to the charge inside the jar. When the current stops, a charge remains stored in the jar. If the inner and outer layers of foil are then connected by a conductor, their opposite charges will cause a spark that discharges the jar.

Gregory Benford



WORLD BOOK photo by Dan Miller

Leyden jar

Leyster, *LY stuhr,* **Judith,** *YOO deet* (1609-1660), was a Dutch painter. She specialized in two popular types of Dutch scenes. One portrayed men drinking and noisily amusing themselves in taverns. The other showed women sitting at home quietly performing domestic tasks.

Leyster was one of the first artists to paint these women's scenes, which became popular later in the 1600's. Leyster's style reflects the influence of the Dutch artist Frans Hals, as in her quick, vivid brushstrokes. Her strong light-and-shadow effects recall the style of the Italian artist Michelangelo Caravaggio, whose school had many Dutch followers in the early 1600's.

Leyster was born in Haarlem. Little is known about her early artistic training, but by the age of 17 she had gained some fame as an artist. Her largest output came from 1629 to 1636, when she married. After her marriage, her production greatly decreased. Ann Friedman

Lhasa, *LAH suh* (pop. 139,822), is the capital and holy city of Tibet. Tibetans consider the city's temples sacred. The Dalai Lama, a spiritual leader and exiled ruler of Tibet, lived in Lhasa until 1959. In that year, he went into exile in India with many of his followers after a failed revolt in Tibet against the Chinese Communists. Until 1904, Europeans were banned from Lhasa, and it is sometimes called *The Forbidden City.*

Lhasa lies about 12,000 feet (3,660 meters) above sea level in the Himalaya of southeastern Tibet. It is one of the highest cities in the world.

Lhasa is a closely packed city of stone and brick houses and shops. The city also has many monasteries and temples. Most of the houses have low, flat roofs and no chimneys. Oiled paper, instead of glass, is used in the windows. The 13-floor Potala Palace stands out above the city. Now a museum, the palace once served as a temple, the center of Tibet's government, and the home of the Dalai Lama. Frederic Wakeman, Jr.

See also **Tibet** (Cities; map).

Lhasa apso, *LAH suh AP soh,* is a dog that came originally from Lhasa, the capital of Tibet. It was once known as a terrier, but it is now classed as a nonsporting dog. The Lhasa apso has a long, heavy coat that looks like a mop. Its hair falls thickly over its face, covering its eyes and ears. It also has whiskers and a beard. The Lhasa apso has a long, low body, and carries its tail curled tightly over its back.


WORLD BOOK photo by E. F. Hoppe

The Lhasa apso originally came from Tibet.

In Lhasa, this dog was used as a watchdog, even though it is only about 10 inches (25 centimeters) high. A large dog guarded the door outside, while the little Lhasa apso stayed inside to warn of danger.

Critically reviewed by the American Kennel Club

See also **Shih Tzu.**

Li Bo, *lee bwoh* (701-762), was one of China's greatest poets. There are several other spellings of his name, but the most common are *Li Po* and *Li Bai.* Li Bo's poetry is admired for its eloquence, wit, humor, and romantic descriptions of nature, especially of the moon. Li Bo also wrote poems praising the virtues of wine. He composed many poems at banquets and special occasions to entertain his friends and patrons. He believed his most important works were his poems on ethics and morality.

Li Bo was probably born in what is now Kyrgyzstan, west of China. His family originally came from China, and they returned to the country when Li Bo was 5 years old. From 725 until his death, Li Bo traveled throughout China, supporting himself by writing poems and documents for wealthy people. David R. Knechtges

See also **Chinese literature** (Poetry).

Li Peng, *lee puhng* (1928-), is one of China's top leaders. He became chairman of the National People's Congress, China's national legislature, in 1998. He headed government operations as premier from 1988 until he was named to the legislative post. Since 1985, Li has been a member of the *Politburo,* the chief policy-making body of China's Communist Party. He has devoted much of his career to developing China's energy resources.


AP/Wide World

Li Peng

In 1989, the Chinese military killed many people demonstrating for democracy in China. Li was one of the leaders who called for the use of force in putting down the demonstration. As a result, his popularity among the people, which had never been high, declined.

Li was born in Chengdu. His father was a revolutionary writer who was executed by China's Nationalist government in 1931. In 1939, Communist leader Zhou Enlai and his wife, Deng Yingchao, took Li under their care. From 1949—when the Communists gained control of China—until his death in 1976, Zhou served as premier of China. Arif Dirlik

Li Po. See **Li Bo.**

Li Yuan, *LEE yoo AHN* (A.D. 566-635), a Chinese emperor, founded the Tang dynasty (A.D. 618-907). Historians consider this dynasty one of the greatest periods in Chinese history.

Li Yuan reigned from 618 to 626. He established Tang control over rebellious sections of central and south China and defeated the Turks who were invading from the north.

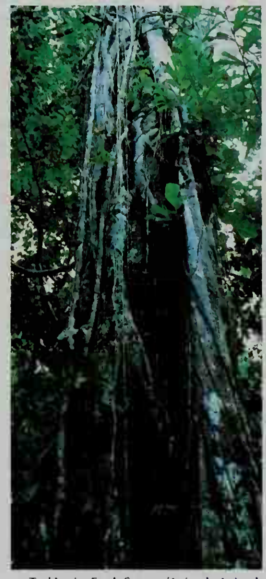
Li Yuan was born in Chang'an (now Xi'an) of a noble

family. He became a general and served from 615 to 617 as military commander in Shanxi province in north China. Li was loyal to the emperor until 617. In that year, Li's son Li Shimin persuaded him to rebel. Li Yuan's forces captured Chang'an, the western capital of the ruling Sui dynasty. In 618, the Sui ruler was murdered during a rebellion, and Li became emperor. In 626, Li Shimin forced his father from the throne and became the second emperor of the Tang dynasty. Grant Hardy

See also **China; Tang dynasty.**

Liana, *lee AH nuh,* is the name for various vines found chiefly in tropical rain forests. Lianas climb on or around the trunks and branches of trees, using the trees for support. They have flexible shoots and grow rapidly.

There are several types of lianas. Some, called *scramblers* or *leaners,* have no special structures for support. They lean against trees as they climb. Other lianas, including kudzu, American bittersweet, and some kinds of honeysuckle, twine around trunks and branches. Many lianas have threadlike tendrils that attach tightly to nearby vegetation or other objects. Such lianas include grapevines, greenbrier, and Virginia creeper. Other lianas, such as ivy and vanilla vines, use *adventitious roots* (roots formed away from the primary root) as a means of attachment. Still other lianas, including certain kinds of bougainvillea, have hooked thorns or prickles for climbing. David S. Seigler



Ted Levin, Earth Scenes/Animals Animals

Lianas are vines that climb tree trunks or other objects.

Libel is a written or printed statement that harms a person's reputation. Pictures, signs, and information broadcast on television or the radio may also be libelous. Individuals are most often the subject of libel, but businesses and groups may be libeled as well. *Slander* is similar to libel. However, slander involves spoken words that damage a person's reputation.

Libel does not consist of writing or developing damaging material, but in showing it. If a writer of harmful material shows it to a person other than the subject of the material, the writer has *published* the libel.

In the United States, a person who believes he or she has been libeled can file a lawsuit in civil court. The *plaintiff* (person filing the charges) must prove three main things: (1) that something was published by the defendant, (2) that the published material was about him or her, and (3) that the material was *defamatory* (damaging) to his or her reputation. Possible defamatory statements include reporting that an individual committed a crime or that a person was repeatedly fired from jobs.

A number of rules in common law add to a plaintiff's burden in a libel suit. For example, defendants cannot be convicted of libel for statements that are true, even if the statements are defamatory. In addition, the legal doctrine of "fair comment" protects defamatory matter that is clearly presented as opinion rather than as fact, as long as the writer is acting without malice and provides readers with the facts that lead to the opinion.

In 1964, the Supreme Court of the United States ruled that the First Amendment of the United States Constitution prevents public officials from winning a libel suit against the press unless the press is guilty of *actual malice.* The court defined actual malice as knowledge of falsity or reckless disregard for the truth. In 1967, the court ruled that *public figures* must also prove actual malice when suing newspapers or other media. The court defined public figures as private citizens who try to influence the outcome of important public issues or who otherwise thrust themselves into the public spotlight.

In 1974, the Supreme Court ruled that private individuals do not have to prove actual malice in a libel suit. But they must at least prove that the media acted negligently in its reporting. In 1990, the court ruled that the First Amendment does not automatically protect defamatory statements of opinion from being found libelous. It said that the common law defense of "fair comment" provides sufficient protection.

Libel laws have come under heavy criticism. Some journalists complain that the mere threat of a libel suit may discourage important in-depth reporting. Many legal scholars believe the actual-malice rule is too confusing for juries. Some attorneys believe that the legal standards for proving that a person's reputation has been damaged are too vague. Many attorneys also believe that the actual-malice rule makes it extremely difficult for a person to win a libel suit, even if his or her reputation has clearly been damaged. Jeremy Cohen

Liberal arts are the areas of knowledge traditionally considered essential for intellectual development and effective citizenship. They originated in ancient Greece and Rome and included two groups of studies. One group dealt with the correct use of language (grammar), thinking clearly (logic), and expressing one's ideas persuasively (rhetoric). The second group included the branches of mathematics and music. Out of these traditional studies came the curriculum of the liberal arts and sciences, which is grouped into the natural sciences, social sciences, and humanities. Colleges that concentrate on these studies are usually called liberal arts colleges. Gerald L. Gutek

Liberal Democrats is the name of a political party in the United Kingdom. The party traces its ancestry to the Whig Party, formed in the late 1600's. It became the Liberal Party in the 1800's. In 1988, it merged with the Social Democratic Party to form the Social and Liberal Democratic Party. The party has been called the Liberal Democrats since 1989. Its members support decentralization of government and greater public resources for education, health services, and the poor. They also favor closer involvement with the European Union than either the Conservative Party or Labour Party does.

Beginnings. Britain's Whig Party emerged in the late 1600's in opposition to the growing power of royalty. In the early 1800's, some of its members formed an alliance with reformers called Radicals. This alliance came to be called the Liberal Party. The early Liberals led a move-

ment in Parliament that resulted in political reforms, including child labor laws and an act that increased representation in Parliament of areas with large populations.

A major party. By the 1850's, the Liberal and Conservative parties replaced the Whig and Tory parties as the United Kingdom's two largest political organizations. In the second half of the 1800's, government control passed back and forth between Liberals and Conservatives. The most famous Liberal leader of the period was William E. Gladstone. He served as prime minister from 1868 to 1874, from 1880 to 1885, in 1886, and from 1892 to 1894. Under Gladstone, the Liberals led a movement for more reforms, including voting rights for the working classes and a system of free elementary schools.

The strength of the Liberal Party continued into the early 1900's. Its leading members of the period included the Earl of Rosebery, prime minister in 1894 and 1895; Sir Henry Campbell-Bannerman, prime minister from 1905 to 1908; Herbert H. Asquith, prime minister from 1908 to 1916; and David Lloyd George, prime minister from 1916 to 1922. Liberal reforms from 1906 to 1914 included the Workmen's Compensation Act, the Old Age Pension Act, and measures to aid the unemployed. Such reforms laid the foundation for Britain's welfare state.

Party split and decline. When Lloyd George became prime minister in 1916, the Liberals and Conservatives set up a *coalition* (partnership) to govern. The coalition led to a split between the Liberal followers of Lloyd George and those of Asquith, who opposed the coalition. The split helped the Labour Party, which had formed in 1900, replace the Liberal Party as the main opposition to the Conservatives. The Liberal Party became much smaller than the Conservative and Labour parties.

Alliance with the Social Democrats. In 1981, some members of Parliament who belonged to the moderate wing of Labour quit that party and formed the Social Democratic Party. In general, the Social Democrats and the Liberals had similar policies. The parties formed an alliance in 1981. In 1983 and 1987, the alliance won about 25 percent of the vote in parliamentary elections. In 1988, most members of the two parties merged to form the Social and Liberal Democratic Party. In 1989, party members began to call themselves the Liberal Democrats. They won about 20 percent of the vote in 1992 elections and about 25 percent in 1997. Paul E. Gallis

Related articles in *World Book* include:

Asquith, Herbert H.	Disraeli, Benjamin	Lloyd George, David
Campbell-Bannerman, Sir Henry	Gladstone, William E.	United Kingdom (History)
Conservative Party	Labour Party	

Liberal Party is a major Canadian political party. In general, it has supported national unity, cooperation between French- and English-speaking Canadians, and the expansion of social welfare programs. The Liberals are sometimes called the "government party" because they have played a dominant role in federal politics since the late 1800's.

The party traces its origins to reform movements in the Province of Canada (later Ontario and Quebec) during the 1850's. Various reform groups, such as the radical Clear Grits, united to oppose the colony's Liberal-Conservative government. After the Dominion of Canada was formed in 1867, the Liberal-Conservatives (later called the Conservatives) gained control of the new country's government. The alliance of reform groups, who called themselves the Liberals, became the opposition party. At first, internal divisions weakened the Liberals. They governed only from 1873 to 1878, with Alexander Mackenzie as prime minister.

In 1896, the Liberals gained power under the leadership of Wilfrid Laurier, Canada's first French-speaking prime minister. He held the post until 1911. His successor as party leader, W. L. Mackenzie King, served three times as prime minister between 1921 and 1948. King secured greater self-government for Canada, led the country through World War II (1939-1945), and created a number of social programs.

Louis S. St. Laurent succeeded King as party leader and prime minister in 1948. St. Laurent was one of the chief architects of the North Atlantic Treaty Organization (NATO), a military alliance of Western nations. After the Conservatives (now called the Progressive Conservatives) defeated the Liberals in 1957, St. Laurent resigned as party leader. His successor, Lester B. Pearson, became prime minister in 1963 and served until 1968. Pearson's government expanded social welfare programs.

In 1968, Pierre Elliott Trudeau succeeded Pearson as party leader and prime minister. Trudeau spent much of his time dealing with the demands of many French-speaking Quebecers for independence from Canada. He fought these separatists fiercely and helped defeat them in a 1980 referendum. Trudeau served as prime minister from 1968 to 1979 and from 1980 to 1984. After his resignation, the Progressive Conservatives won control of the government and held power until 1993.

The Liberals returned to power in 1993, and party leader Jean Chrétien became prime minister. Chrétien's government cut spending to reduce the federal deficit and the national debt. By the late 1990's, the government reported a budget surplus. J. L. Granatstein

Liberal Party (in United Kingdom). See **Liberal Democrats.**

Liberal Republican Party was a United States political party formed in 1872 to oppose the reelection of President Ulysses S. Grant. It was made up of members of the Republican Party who suspected Grant's administration of corruption. They also disliked Grant's policies on civil service, tariff reform, and the South. Liberals and reformers started the party, but it soon attracted a mixed group of politicians. The party members found it difficult to agree on a candidate or a platform at the party convention, which was held in Cincinnati, Ohio.

In the end, the party nominated newspaper editor Horace Greeley for the presidency on a platform of "universal amnesty and universal enfranchisement." This meant the immediate establishment of civil governments in each of the former Confederate States, and the removal of all restrictions on the political rights of their citizens. The Liberal Republican Party, even with Democratic support, was badly defeated in the election of 1872 and quickly disappeared. Donald R. McCoy

See also **Grant, Ulysses S.** (Election of 1872).

Liberalism is a political and economic philosophy that emphasizes freedom, equality, and opportunity. The philosophy called *conservatism,* in contrast, stresses order, tradition, and ownership of private property. Liberals have generally urged more rapid social change than conservatives have favored. But liberalism is a con-

fusing term, because its meaning and emphasis have changed considerably over the years.

Early liberalism. The right to rebel against a government that severely restricts personal freedom was one of the chief doctrines of early liberalism. Liberal ideas inspired England's Glorious Revolution of 1688, the Revolutionary War in America (1775-1783), and the French Revolution (1789-1799). Liberal revolutions led to the establishment of many governments based on rule by law and by the consent of the governed. Many such constitutional governments had detailed bills of rights that proclaimed the individual's right to freedom of speech, the press, assembly, and religion. The bills of rights also attempted to provide safeguards against the abuse of police and judicial power. The liberal philosophy is clearly stated in the Declaration of Independence and in the writings of Thomas Jefferson. Jefferson, in turn, was influenced by the English philosopher John Locke.

Early liberals favored constitutional government, but they usually distrusted democracy. They tried to restrict the exercise of political power to members of the property-owning middle class. But as the industrial working class grew larger, it adopted the liberal principle that government should rest on the consent of the governed. By the late 1800's, a liberal was a person who favored democracy and voting rights for adult citizens.

Political and economic liberalism were closely connected until the 1900's. Early liberals argued that all people benefit most when each individual is allowed to follow his or her own self-interest. They believed that the economy is self-regulating if left alone to operate according to its own rules. Therefore, they concluded, government regulation is unnecessary. The ideas of economic liberalism were arranged into a system by the Scottish economist Adam Smith. This system was called *capitalism,* or *free enterprise.*

Liberalism today. Liberalism underwent a major change of emphasis after 1900. In the late 1800's, many liberals began to think of freedom less in terms of freedom from restriction, and more in terms of freedom of opportunity. They became convinced that government action is often necessary to provide the conditions under which individuals can realize their potential.

Today, liberals favor government regulation of the economy in the public interest. They support government programs to provide economic security and ease human suffering. Such programs include unemployment insurance, minimum-wage laws, old-age pensions, health insurance, civil rights legislation, and antipoverty measures. Modern liberals believe in the importance of individual freedom. But they maintain government must remove obstacles to the enjoyment of that freedom. Supporters of the earlier ideas of economic liberalism are now frequently called *conservatives.* Some former liberals often called *neoliberals* favor less government regulation of the economy. They also express a sense of limits about government in general. Alonzo L. Hamby

See also Americans for Democratic Action; Conservatism; Great Society; Political science (Liberalism); Welfare state.

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Liberation theology is a movement that seeks to involve the Roman Catholic Church in struggles for social reform and human rights. The movement began within the church in Latin America and has had its greatest influence there. The movement's followers believe poverty is against the will of God. Liberation theologians in Latin America charge that wealthy, industrialized nations treat Latin Americans unfairly. They also claim that Latin American governments have not done enough to eliminate poverty in their own countries. In addition, they claim that some Latin American governments have systematically violated their citizens' human rights.

Liberation theology began in the 1960's when Latin American bishops and priests established groups called *base communities* for Bible study, prayer, and social action. Millions of Christians throughout Latin America have gathered in base communities. They have helped the poor through efforts such as digging wells, building clinics, and petitioning the government for schools.

A Peruvian priest, Gustavo Gutiérrez, is widely considered the founder of liberation theology. The movement takes its name from his 1971 book, *A Theology of Liberation,* first published in English in 1973. In his book, Gutiérrez calls for the church to liberate people from unjust and degrading conditions and sees poverty as such a condition.

Liberation theology has many opponents, especially among Roman Catholic leaders and Latin American governments. Since the 1980's, the Vatican has replaced liberation theologians with traditionalist priests throughout Latin America. Some Catholic leaders believe the movement jeopardizes the church's stability and wrongly stresses worldly concerns instead of spiritual matters. Most liberation theologians oppose the use of violence. But some of the movement's supporters have taken part in violence against Latin American governments.

Some people regard liberation theology as supporting Communism. Liberation theologians, however, say that they reject Communism in general, though they sometimes use Marxist ideas to analyze social problems.

Roberto S. Goizueta

Liberia is the oldest black republic in Africa. The country was founded on the west coast of Africa by freed slaves who were sent there by a colonization society in the United States. These freed slaves were joined by others who had been freed from slave ships bound for the United States. The name *Liberia* is derived from a Latin phrase meaning *free land.*

Liberia's land features include mountains, forested plateaus, and a rugged coastline. The country has a hot, humid climate. Most of Liberia's workers are farmers. Monrovia, the country's capital, is also its largest city.

Government

A president heads Liberia's government. The voters elect the president to a six-year term. The president appoints a Cabinet to carry out the functions of the government. The legislature passes the nation's laws. It consists of a 26-member Senate and a 64-member House of Representatives. The voters elect senators to six-year terms

Facts in brief

Capital: Monrovia.
Official language: English.
Area: 43,000 mi² (111,369 km²). *Greatest distances*—east-west, 230 mi (370 km); north-south, 210 mi (338 km). *Coastline*—315 mi (507 km).
Elevation: *Highest*—Nimba Mountains, 4,528 ft (1,380 m) above sea level. *Lowest*—sea level along the coast.
Population: *Estimated 2002 population*—3,385,000; density, 79 per mi² (30 per km²), distribution, 55 percent rural, 45 percent urban. *1984 census*—2,101,628.
Chief products: *Agriculture*—rubber, cassava, rice, coffee, bananas, cacao. *Forestry*—mahogany. *Mining*—iron ore.
National anthem: "All Hail Liberia, Hail."
Flag: The flag has 6 red and 5 white horizontal stripes that represent the 11 signers of the Liberian Declaration of Independence. A white star appears on a dark blue canton in the upper left corner. Adopted in 1847. See **Flag** (picture: Flags of Africa).
Money: *Basic unit*—Liberian dollar. One hundred cents equal one dollar.

Liberia

International boundary
Road
Railroad
National capital
Other city or town
Elevation above sea level





WORLD BOOK maps

and House members to four-year terms. All Liberian citizens 18 years of age or older are allowed to vote. Important political parties include the National Patriotic Party and the Unity Party.

Liberia is divided into 13 counties. Each county has a superintendent appointed by the president.

A Supreme Court heads Liberia's main court system. The Supreme Court has a chief justice and four associate judges. All Supreme Court judges are appointed by the president. Another court system judges cases based on African customary law.

People

Almost all of Liberia's people are black Africans. Small groups of Americans, West Europeans, Lebanese, and Asian Indians also live in the country. The African population is made up of two main groups—the *indigenous* (native) Africans, whose ancestors have lived in the area for hundreds of years; and the Americo-Liberians, who are descended mainly from African American settlers sent from the United States.

The indigenous Africans account for about 95 percent of Liberia's population. They are divided into 16 ethnic groups, each of which has its own language, customs, history, and territory. The largest groups are the Kpelle, who live in central Liberia, and the Bassa, who live along the coast. Other groups include the Gio, Krahn, Kru, Mandingo, and Mano.

The Americo-Liberians make up about 5 percent of the population. They live in coastal cities and towns. In general, the Americo-Liberians have been far better off than the indigenous Africans. Before a group of indigenous Africans revolted in 1980, Americo-Liberians controlled the country's political system. The revolt brought indigenous Africans to power.

City life. In Liberia's cities, some people live in expensive homes, but most live in small, tin-roofed wooden houses. The cities of Liberia have large buildings and stores, movie theaters, and busy streets. Many Liberians who live in cities or towns have electric power and running water in their houses.

People who live in urban areas work in schools, stores, factories, and government offices. Many also work as carpenters, doctors, taxi drivers, or servants. Many women who live in urban areas travel to rural areas daily to work on farms. Family life is important in Liberia. Extended families—in which married children and their offspring live with the parents—are common in the cities.

Rural life. In the rural areas, people live in small villages. Most people live in mud houses with thatched roofs. Almost no homes in rural Liberia have electric power or indoor plumbing.

Most people in rural Liberia work as farmers. Many people who live along the coast fish for a living or work aboard ships. As in the urban areas, extended families are common in Liberia's rural areas.

Religions and languages. About 30 percent of the people of Liberia are Christians, and about 20 percent are Muslims. However, most Liberians—especially those in rural areas—follow traditional religious beliefs of their ethnic group.

English is Liberia's official language. It is used in government and business and is taught in the schools. Each African ethnic group has its own language, and some also have several distinct dialects.

Education. Liberia's school system includes six years of elementary school and six years of secondary school. The government supports some of Liberia's schools. Others are run by missionaries. By law, children must attend all 12 grades. But only about 60 percent of the children fulfill this requirement. School attendance is much lower for girls than it is for boys. Liberia lacks an ade-



Monrovia is the capital and largest city of Liberia. It stands on the Atlantic Coast of Africa at the mouth of the St. Paul River.

Michelle Burgess, SuperStock

quate number of schools, especially in the rural areas. The country also has shortages of teachers and teaching materials.

Liberia has one university, one college, and three technical or trade institutions. Less than 1 percent of the people of Liberia attend school beyond the secondary level. Most of the country's people cannot read and write. For Liberia's literacy rate, see **Literacy** (table: Literacy rates for selected countries).

Land and climate

Liberia has a rugged coastline. A narrow coastal plain extends inland from the coastline, and the land gradually rises to a plateau region with low hills. This region includes the Bomi Hills and the Bong Range. Higher elevations of the plateau region have forests of evergreen and deciduous trees, including ironwood and mahogany. Its valleys have grasses with scattered trees. Highlands in the northern and northwestern parts of Liberia include the Wologizi and Nimba mountain ranges. Liberia's most important rivers are the Cavally (also spelled Cavalla), which forms Liberia's border with the Ivory Coast; and the St. Paul, which flows through the mountains in the north.

Liberia's climate is hot and humid. The country has an average annual temperature of 80 °F (27 °C) along the coast. Most of Liberia has a dry season and a rainy season. On the coast, the dry season lasts from December to March. However, the dry season lasts longer in inland areas of the country. Annual rainfall on the coast of Liberia averages 200 inches (510 centimeters). Inland areas receive about 85 inches (220 centimeters) of rain each year.

Liberia once had much wildlife. But hunters killed most of the wild animals. Some elephants, crocodiles, pygmy hippopotamuses, antelopes, and leopards still live in the east and in the northwest.

Economy

About 75 percent of Liberia's employed people work in agriculture. But agriculture contributes only about 20 percent of Liberia's *gross domestic product* (GDP). The GDP is the total value of all goods and services produced in the country within a year. Service industries account for about 54 percent of Liberia's GDP and employ about 16 percent of the work force. Mining accounts for about 14 percent of the GDP and employs about 6 percent. Manufacturing and construction together account for approximately 12 percent of the GDP and employ about 3 percent.

Agriculture is the chief occupation in Liberia. Many Liberian families raise crops on small plots of land owned by their communities. Cassava, rice, sugar cane, and tropical fruits are the chief food crops. Most of the farmers also raise sheep, goats, pigs, and other livestock. Most Liberian farmers use old-fashioned farming methods, and few have modern farm machinery. Liberia's farmers produce goods mainly for their own families, and so there is little to sell to city dwellers. As a result, the country must import much of its food.

Large rubber plantations owned by foreign companies employ many Liberians. Farmers on these plantations use modern methods to produce rubber, Liberia's main agricultural export. Other crops exported from Liberia include *cacao,* which is used to make cocoa, and coffee.

Liberia has some large forest areas. Timber cut from these regions is exported, used for firewood, or made into lumber for the construction of houses.

Service industries are economic activities that produce services rather than goods. Such industries have become increasingly important to Liberia's economy. The most important service industries are government activities, finance, insurance, and real estate.

Mining. Almost all of Liberia's mining income comes from iron ore, the country's most valuable export. A company jointly owned by Italians and Germans mines iron ore in Liberia. Liberian prospectors mine small amounts of gold and diamonds.

Manufacturing. Factories in Liberia produce soap, beverages, and explosives and process farm, forest, and mining products. Liberia has an oil refinery.

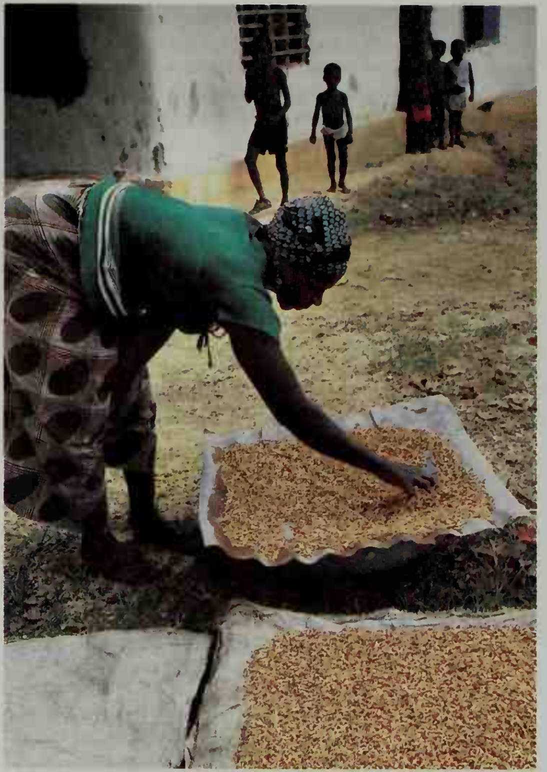
Transportation and communication. Most of Liberia's roads are unpaved. Railroads built by mining companies carry freight between the companies' mines and ports in Monrovia and Buchanan. Monrovia has two airports. Few Liberians own an automobile. City dwellers usually walk or take taxis or buses. Most rural Liberians travel on foot. One of the largest merchant fleets in the world is registered under the Liberian flag. But only a few ships are owned by Liberians. The rest are owned by people from other countries who register their ships in Liberia because taxes are lower there.

Liberia has 3 daily newspapers. The country has an average of about 1 radio for every 4 people. Less than 2 per cent of all Liberians own a TV set.

History

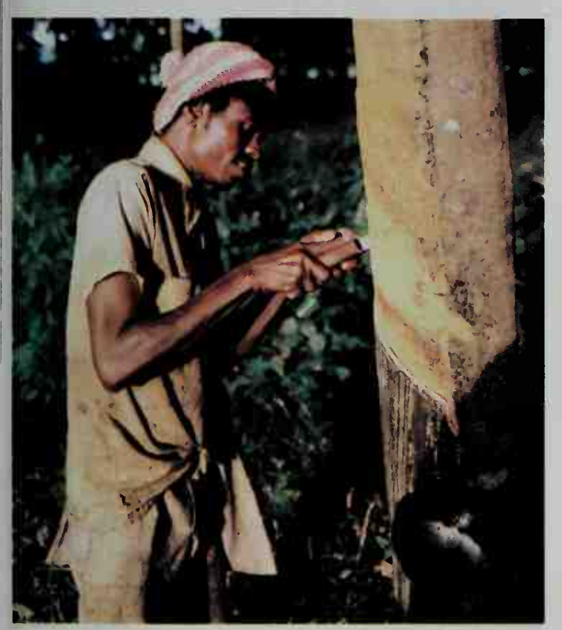
Early days. The ancestors of today's native Liberians probably came from kingdoms in Sudan between the 1100's and the 1500's. In the 1400's, Portuguese explorers began to trade with the people who lived along the coast of what is now Liberia. The Portuguese traded for ivory, spices, and slaves who were taken from the inland region. The traders greatly prized a spice called malagueta pepper, which they called the "grain of paradise." Thus, the region became known as the *Grain Coast.*

The Liberian settlement. In the late 1700's and early 1800's, many white people in the United States became concerned over the existence of freed slaves in their country. Some slaveowners believed that the existence of freed slaves increased discontent among those still in slavery. Other white people objected to the integration of the black freed slaves into their society. In 1816, a group of whites set up the American Colonization Society (ACS) to return free blacks to Africa. The ACS bought land along the Grain Coast and started a settlement. They named it Monrovia, after President James Monroe.



© Thomas S. England, Photo Researchers

Farmers in rural Liberia live in small villages. Liberia's farmers grow food mainly for their own families. In the picture above, a woman sets out grain to dry in the sun.



© Homer Sykes, Woodfin Camp, Inc.

Workers tap rubber trees and collect latex on plantations. Rubber has been a chief source of income since the 1930's.

In 1822, the first group of freed slaves arrived at the settlement by ship. They were joined by many black Africans whom the U.S. Navy had removed from ships that were illegally transporting slaves. The settlers faced many difficulties. They had trouble finding food. Many died from disease. The natives feared losing their land to the Americo-Liberians and often attacked the settlers.

In 1838, the Monrovia settlement joined with others that had been established in the region to form the Commonwealth of Liberia. The commonwealth handled some of its own affairs, but it was controlled by the ACS. Joseph Jenkins Roberts, an Americo-Liberian from Virginia, became governor. Jenkins tried to increase trade income by establishing *customs duties* (taxes on imports and exports). But European traders refused to recognize the right of the commonwealth to do so. Disputes also arose between the settlers and the ACS. Many Americo-Liberians sought independence, and members of the ACS resented the expense of supporting Liberia. Liberia became an independent nation on July 26, 1847. Roberts became its first president.

The Republic of Liberia. The customs duties Liberia placed on its imports and exports increased the cost of trading with the country. Liberia's trade declined and its economy suffered. In the late 1800's and early 1900's, Liberia's government was forced to take large loans in foreign countries to pay its bills. It could only obtain funds to repay its debts by raising customs duties.

In 1926, the Liberian government agreed to lease large amounts of land to the American Firestone Company for rubber plantations. The rent paid by the company provided important income to the country. The plantations also created jobs for many Liberians.

William V. S. Tubman became president of Liberia in 1944. Tubman was determined to develop the economy and to integrate the Americo-Liberians and indigenous African populations. During Tubman's rule, foreign trade expanded and the mining of iron ore grew considerably. Tubman's policies aimed at providing more political and economic opportunities for the indigenous Africans. But Tubman still wanted the real power to remain with a small group of Americo-Liberian families that had dominated Liberia for most of its history.

The 1970's and 1980's. Tubman died in 1971. He was succeeded by Vice President William R. Tolbert, Jr., another Americo-Liberian. Tolbert tried to follow Tubman's policies, but he faced major problems. Iron ore and rubber prices dropped, and the economy suffered badly. In 1979, a rise in the cost of rice caused riots and looting. Under Tolbert's rule, the rich prospered while the poor became poorer. In 1980, a group of military men from the indigenous Liberian population killed Tolbert and took control of the government. They installed Samuel K. Doe, an army sergeant, as president.

In 1985, elections were held to choose a president and a legislature. Doe was declared winner of the presidency, and his party—the National Democratic Party of Liberia—was awarded a majority of seats in the legislature. However, many people believe the elections were *rigged* (fixed) by Doe and his supporters. Doe's new government took office in 1986. During his reign, Doe had many opponents imprisoned or killed.

Recent developments. A rebellion against Doe began in late 1989. In 1990, it developed into a bloody civil war. Two rebel groups—the National Patriotic Front of Liberia (NPFL) and the Independent National Patriotic Front of Liberia (INPFL)—fought with each other and with the Armed Forces of Liberia (AFL). The NPFL and INPFL consisted mainly of members of the Gio and Mano ethnic groups. The AFL consisted mainly of Doe's ethnic group, the Krahn, and the Mandingo. In September 1990, the INPFL killed Doe. After Doe's death, the three groups continued to fight. West African peacekeeping forces were sent to Liberia to protect the Krahn and help restore order. In November 1990, all parties agreed to a cease-fire. A new government took control of the capital. The NPFL controlled much of the countryside. In October 1992, the NPFL attacked the capital, and fighting resumed among rebel groups. Transitional governments were formed in 1994 and 1995. But violence continued. In August 1996, warring factions signed a peace agreement ending the civil war. In July 1997, presidential and legislative elections were held. Mark W. DeLancey

See also Monrovia; Tubman, William V. S.; Russwurm, John B.

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Libertarian Party is an American political party that favors increasing individual liberties by limiting government activities. The party's platform combines liberal views on personal freedoms with conservative economic beliefs. Libertarians believe that government is the main threat to individual liberties. For this reason, the party supports the repeal of most laws that limit freedom of personal behavior. Libertarians also feel that many services presently provided by government should be supplied by private firms instead. The Libertarian Party opposes government aid to and regulation of business. It favors a neutral foreign policy for the United States, including withdrawal from the United Nations (UN) and an end to any U.S. military role abroad.

The Libertarian Party was founded in 1971. It publicizes its views by entering candidates in some elections for federal, state, and local offices. Murray Clark Havens

Liberty. See Freedom.

Liberty, Statue of. See Statue of Liberty.

Liberty Bell is a treasured relic of the early days of American independence. It was rung on July 8, 1776, for the first public reading of the Declaration of Independence. Its inscription, "Proclaim Liberty throughout all the land unto all the inhabitants thereof," is from the Bible (Leviticus 25:10).

The Liberty Bell weighs over 2,080 pounds (943 kilo-



Artstreet

The Liberty Bell is a symbol of American independence. It was rung on special occasions from 1753 until 1841, when it cracked.

grams). The colonial province of Pennsylvania paid about $300 for it in 1752. Today the bell hangs in Liberty Bell Pavilion, just north of Independence Hall in Philadelphia.

The Liberty Bell was first cast in England. It broke in ringing after its arrival and was recast in Philadelphia from the same metal, with the same inscription, in 1753. For nearly 100 years, the Liberty Bell rang on many special events, to call people to gather together. The bell cracked in 1841. It became known as the Liberty Bell about 1839, when abolitionists began to refer to it that way. Previously, the bell had been called the Old State House Bell.

The Liberty Bell is no longer rung, but it has been struck on special occasions. On June 6, 1944, when Allied forces landed in France, Philadelphia officials struck the bell. Sound equipment broadcast the tone to all parts of the nation. Independence Hall was the permanent residence of the bell from 1753 until Jan. 1, 1976, when it was moved to the pavilion. Theodore Hershberg

Liberty Island is an island in Upper New York Bay on which the Statue of Liberty stands. The 12-acre (5-hectare) island lies about 1 $\frac{1}{2}$ miles (2.4 kilometers) southwest of Manhattan Island. Before the island was officially renamed in 1956, it was called Bedloe's Island. The Statue of Liberty, given by France in 1884, was dedicated on the island in 1886. It stands on a pedestal that rises from within Fort Wood, whose walls were built in the shape of an 11-point star between 1806 and 1811. There was a military post on the island until 1937. The Statue of Liberty National Monument was established in 1924, but it did not include the land outside the walls of Fort Wood. The remainder of the island became part of the national monument in 1937. The island is administered by the National Park Service. Offices and housing for National Park Service employees are located on the island. New York state has official jurisdiction over the island.

Michael K. Heiman

See also Statue of Liberty.

Liberty League, also called the American Liberty League, was an organization that tried to rally public opinion against President Franklin D. Roosevelt's New Deal. Conservative Democrats who disapproved of Roosevelt's New Deal measures founded the group. Prominent members included John W. Davis and Alfred E. Smith, the Democratic presidential candidates in 1924 and 1928. In 1934, they combined with wealthy business executives, who provided most of the league's funds. The league published pamphlets and sponsored radio programs, arguing that the New Deal was destroying personal liberty. However, the league failed to gain support in the 1934 and 1936 elections, and it rapidly declined in influence. The league was officially dissolved in 1940. James S. Olson

Liberty Party was the first political party in the United States to give most of its attention to the slavery question. The politician James G. Birney and the poet John Greenleaf Whittier were the leading supporters of the group. From July 1844 to March 1845, Whittier edited the *Middlesex Standard,* a paper published in Lowell, Massachusetts, by the Liberty Party. He was also chiefly responsible for editing the *Essex Transcript,* another of the Liberty Party's publications.

The Liberty Party nominated Birney for president in 1840, but he made a poor showing in the election. He also headed the ticket in 1844 and polled 62,000 votes. In 1848, the party met in Buffalo, New York, with other groups to form the Free Soil Party. Donald R. McCoy

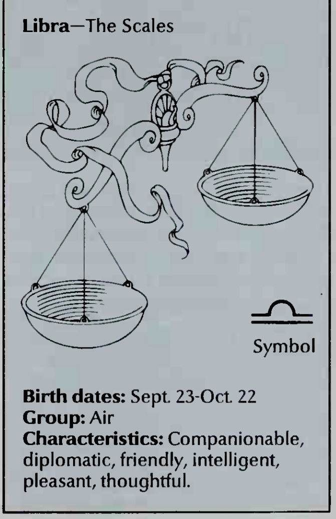
See also Abolition movement (In the United States); Free Soil Party.

Libido, *luh BEE doh,* is a psychoanalytic term referring mainly to the energy of natural instincts or urges that motivate behavior. Austrian physician Sigmund Freud was the first to use the term (see Freud, Sigmund).

Some psychoanalysts believe that the libido develops through certain stages. In the *oral* phase, the infant derives pleasure from such activities as sucking and biting. In the *anal* phase, the child obtains satisfaction and interest in bowel control. In the *genital* phase, sexual instincts are organized for the purposes of love and sexual reproduction. Some psychoanalysts believe problems in the development of the libido and its expression can cause character disorders and symptoms of the milder mental illnesses called *neuroses.* Allen Frances

See also Psychoanalysis and its *Related articles.*

Libra, *LEE bruh,* is the seventh sign of the zodiac. It is symbolized by a pair of weighing scales. Astrologers believe that Libra is ruled by the planet Venus, which is named for the ancient Roman goddess of love and beauty. Libra is an air sign.



Signs of the Zodiac
Aries
Mar. 21–Apr. 19
Taurus
Apr. 20–May 20
Gemini
May 21–June 20
Cancer
June 21–July 22
Leo
July 23–Aug. 22
Virgo
Aug. 23–Sept. 22
Libra
Sept. 23–Oct. 22
Scorpio
Oct. 23–Nov. 21
Sagittarius
Nov. 22–Dec. 21
Capricorn
Dec. 22–Jan. 19
Aquarius
Jan. 20–Feb. 18
Pisces
Feb. 19–Mar. 20

WORLD BOOK illustration by Robert Keys

Astrologers consider people born under the sign of Libra, from September 23 to October 22, to have the characteristics of scales. Libras like balance and harmony in all things and dislike conflict, disagreement, and sudden changes. They are warm, friendly, and sociable. They also are intelligent and thoughtful and are good at patching up quarrels between others. Libras often have trouble making up their minds because they are quick to listen to different viewpoints and reach a compromise. Libras have a love of pleasing surroundings and an eye for beauty. They have a pleasant smile that comes naturally and often. Christopher McIntosh

See also Astrology; Horoscope; Zodiac.

Librarian. See Library.



Cameramann International, Ltd.

Libraries play an important role in the work, education, and recreation of millions of people. A typical public library, *shown here,* provides a wide variety of materials and services. The people shown are using indexes, a computer database, and other resources to locate information.

Library

Library is a collection of books, periodicals, films, recordings, computer databases, or other media. Libraries form a vital part of the world's systems of communication and education. They make available knowledge that has been accumulated through the ages. People in all walks of life use library resources in their work, including students, teachers, scholars, scientists, business executives, and government officials. Large numbers of people also turn to libraries to satisfy a desire for knowledge or to obtain material for some kind of leisure-time activity. In addition, many people enjoy book discussions, concerts, film programs, lectures, story hours, and a variety of other activities provided by libraries.

Libraries also play an important role in preserving a society's cultural heritage. For example, some libraries have special collections of rare books, authors' original manuscripts, or works of local artists. In addition, many librarians develop exhibits and offer programs in libraries to help people learn about their own community or about the culture of other civilizations. All in all, the library ranks as one of society's most useful service institutions.

The first section of this article, *The library today,* provides an overview of the varied contents and kinds of libraries, and discusses the many services these important institutions provide. It also deals with the challenges and problems faced by librarians and libraries. Other parts of the article describe in detail the different types of libraries that are designed to serve different people. The article discusses libraries in all parts of the world and careers in library work. The article also traces the history of libraries. For detailed information on how to use a library, see the section *A Student Guide to Better Writing, Speaking, and Research Skills* in the Research Guide/Index, Volume 22.

The contributors of this article are Mohammed M. Aman, Dean and Professor at the School of Library and Information Science of the University of Wisconsin at Milwaukee; Toni Carbo, Dean of the School of Library and Information Science of the University of Pittsburgh; Dan O. Clemmer, Head Librarian of the U.S. Department of State Library; Kenneth E. Dowlin, City Librarian for the San Francisco Public Library; Michael E. D. Koenig, Dean and Professor at the Graduate School of Library and Information Science of Rosary College; Constance W. Nyhan, former Graduate Adviser at the Graduate School of Library and Information Science of the University of California at Los Angeles; Joanne E. Passet, Associate Professor at the School of Library and Information Science of Indiana University at Bloomington; Gary E. Strong, Director of the Queens Borough Public Library in Jamaica, New York; Kay E. Vandergrift, Associate Professor at the School of Communication, Information and Library Studies of Rutgers University; and Duane E. Webster, Executive Director of the Association of Research Libraries.

Today's libraries differ greatly from libraries of the past—not only in contents, kinds, and services, but even in physical layout and atmosphere. In turn, future libraries will differ from those of today. This is so because libraries constantly strive to expand and perfect the contributions that they make to society.

Contents and kinds of libraries

Variety of contents. The contents of libraries have changed so much through the years that the word *library* itself is, in a sense, inaccurate. The word comes from the Latin word *liber,* which means *book.* It is used because libraries traditionally were largely collections of books. Today's libraries house many books, of course. However, they also have a wide variety of other materials that communicate, educate, and entertain. These materials include magazines, manuscripts, newspapers, pamphlets, and computers. Audio and visual materials include compact discs, audiocassette tapes, videotapes, films, maps, paintings, and photographs.

In addition to regular books, a library may have large-type books, braille books, and tape recordings of books, called *talking books.* Librarians keep pace with the changing contents of libraries to serve as many people as possible. Their efforts have turned libraries into *multimedia resource centers,* which house educational and recreational materials in a variety of forms.

The expansion of library contents greatly increases the library's ability to communicate and educate. For example, people interested in classical music can listen to compact discs and read books on the topic. Students of agriculture can read magazines and watch videotapes on farming methods. Immigrants to the United States can find pamphlets on becoming a citizen and read books on U.S. customs in their original language. Many people use magazines and newspapers to find the most up-to-date material on current events.

Variety of kinds. In addition to expanding contents, librarians have developed many kinds of libraries to serve the needs of different people. The materials of each kind of library are selected to meet the needs of a specific group of patrons. College, university, and research libraries maintain large collections of detailed research materials for advanced students and scholars. School libraries have collections that provide the information needed by elementary and high school students. Public libraries tailor their collections to the general public. Government library collections are geared chiefly toward serving the needs of government officials. Thousands of special libraries provide information for professional people, such as advertising specialists, bankers, editors, engineers, lawyers, physicians, and scientists. Each kind of library mentioned in this paragraph is discussed in detail later in the article.

Library services

Before the mid-1800's, most libraries were privately owned. Only certain people could use libraries, such as scholars, clergy, university students, and the wealthy. Years of effort by librarians and other concerned citizens have radically changed the narrow role of libraries. These people have made the library the widespread, vital service institution that it is today. In many parts of the world, library materials are available to anyone who wants to use them. Librarians have extended library services far beyond making materials available. They offer many forms of assistance to library users. Librarians also work to interest people in library use, and they engage in a variety of activities that make the library an active force in society.

Providing materials. Viewed historically, the library's role of making materials available ranks among the most important contributions ever made to human culture and technology. Libraries have long stored mate-



WORLD BOOK photo

School libraries serve students by providing materials for a wide range of purposes and interests. The children in this library are studying some of its collection of paintings and art books to help them with a school assignment.



The British Library Board

The British Library in London is the national library of the United Kingdom. The library's collection includes millions of books as well as maps, historical documents, and other items. This photograph shows the Humanities Reading Room at the library.

rials that enable ideas, knowledge, and experiences to be passed on from generation to generation. Without this line of communication, cultural and technological developments would not be nearly as advanced as they are today.

Viewed as a factor in day-to-day life, library collections serve as important resources in the education, work, and recreation of millions of people. To students, the library is a place where they can find materials that help them carry out school assignments. It is also a place where students can pursue knowledge beyond their classrooms, beyond their textbooks, and beyond their teachers. People can use libraries to continue learning throughout their lives.

Professional people in many fields rely on materials in special libraries for information they need in their work. Before going into court for a legal case, for example, a lawyer may spend hours in a law library studying cases to prepare arguments. Doctors use medical libraries to obtain information they need to treat unusual or complicated diseases. Many business executives find that library materials help them make informed decisions about their work.

Many people fill their leisure time using library materials. Reading, viewing films, and listening to recordings rank among the most popular leisure-time activities, and libraries supply materials for all of them. Large numbers of people use a library to help them carry on a hobby. For example, stamp collectors can find books, pamphlets, and other materials to aid them. Amateur furniture makers can find instructions for building various pieces of furniture. Other people visit a library to browse for something that will capture their interest and provide an escape from the day-to-day world. A weary office worker, for example, might find that the novels in a library offer a good way to unwind after a busy day.

The job of providing materials for library patrons is a challenging one. To do it well, a librarian must constantly stay aware of new materials and developments in technology. The librarian evaluates vast amounts of materials—either through personal inspection or by reading reviews—and decides which ones should be available in the library.

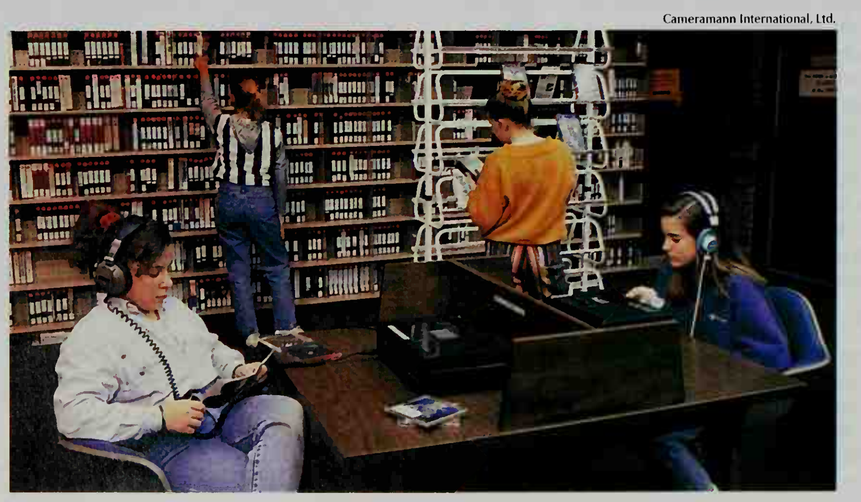
Because library budgets are limited, the amount of desirable material always exceeds the amount that libraries can afford. Therefore, a librarian must have skill in money management, good judgment, and the ability to keep informed about library developments. Many librarians agree to share materials among their libraries so that users have access to more items than a single collection holds.

Assisting patrons. The service provided by librarians goes far beyond getting and arranging library materials. Librarians help anyone who wants assistance in finding information. In all kinds of libraries, this service involves teaching people how to use library resources, helping them find material to answer their questions, and supplying answers to their questions. If the library lacks some material a patron needs, the librarian may direct the patron to a source that has the material. Sometimes a librarian obtains items from an *interlibrary loan system,* which is an arrangement among libraries to share books and other materials.

Many libraries have a question-answer service called a *reference service* or *information service.* A reference librarian may be called on to answer any kind of question. These include basic reference questions, such as "Who was the first Vice President of the United States?" and "What is the population of British Columbia?" Other questions require more descriptive answers, such as telling how a hummingbird hovers or how wastepaper is recycled. Some libraries have librarians who receive and answer basic questions by telephone. This service saves much time for library patrons. Reference librarians deal increasingly with social issues as libraries increase their community-service activities. Librarians, for example, often help organizations prepare programs on drug abuse or environmental pollution. Many libraries provide meeting rooms for community organizations.

Active community service. All libraries serve some kind of community—a town, city, state, nation, school, college, or business. A library serves by providing materials and assisting patrons. But librarians serve their

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Young people listen to recordings in the audio-visual section of a library. Libraries today are *multimedia resource centers* that house compact discs, audiocassette tapes, videotapes, and a wide variety of other materials.



WORLD BOOK photo

Music helps tell a story during a library story hour, *above.* A skillful storyteller not only entertains young library patrons but also can help encourage children to read on their own.

communities in many other ways.

Public libraries sponsor a variety of activities. These activities include story hours for children, career classes for teen-agers, and book clubs for adults. Many libraries offer lecture programs or display works by local artists. Libraries may also hold classes for immigrants and provide tutors to help people learn to read.

Librarians often take materials to people in the nearby community. Some libraries operate a bookmobile service, which carries materials throughout cities, towns, and rural areas. Branch libraries each serve a different neighborhood in a community. Librarians visit people in hospitals, prisons, rural homes, centers for senior citizens, and other places that do not have adequate materials. In the inner city, librarians may set up collections in social service agencies, stores, or homes. Librarians often broadcast useful information on cable television for people who cannot easily visit the library.

School libraries supply materials that students and teachers need for their work. The librarians teach students how to use a library—a skill that will benefit them throughout life. School librarians may also take part in the development of new teaching plans. Government libraries supply public officials with materials they need in their work. But these libraries also serve by distributing materials and coordinating activities among libraries in their state or nation. See also the following sections of this article for discussions of library services: *Public libraries; School libraries; College, university, and research libraries; Government libraries;* and *Special libraries.*

Other features

The contents, kinds, and services of libraries have improved through the years. But improvements extend even further. Librarians today realize that pleasant, comfortable surroundings aid patrons in their studies. Many libraries of the past would seem somewhat dark, dismal, and unattractive by today's standards. Modern libraries are planned so there is plenty of light from windows and artificial lighting systems. The arrangement of furniture and fixtures makes libraries pleasant and easy to use. The buildings of many modern libraries rank among the most attractive in their communities.

Librarians today provide easier access to materials in their libraries than ever before. For example, many libraries now use an *open-stack* or *open-shelf system.* This system permits people to look up and review library material firsthand. The system differs from the older *closed-stack* or *closed-shelf system,* under which people must ask librarians to find material for them.

In addition, libraries help people become familiar with new technologies. Librarians may teach people to locate information with computerized catalogs of resources, called *on-line public access catalogs.* Some libraries provide personal computers for general use by community members.

Challenges and problems

In spite of all their progress, libraries—like all institutions in today's complex world—face many challenges and problems. A major challenge for libraries is how to keep up with the rapid growth of information and technology. Important problems include finding adequate finances to support library services, developing security measures to protect valuable library materials, and resolving difficulties related to the practice of photocopying and to the controversy over censorship. Librarians must also find ways to save decaying books in many of the world's libraries.

The growth of information and technology. Each year, more information becomes available about every subject that interests people. The volume of material in print doubles every 5 to 10 years.

The growing amount of information in modern society poses challenges for librarians. It means that librarians must keep informed about more materials than ever before. As a library increases its purchases, the librarian's job of arranging and storing materials becomes harder. The large amount of available information can also make it difficult to locate materials.

Fortunately, technological advances have provided librarians with help in dealing with information. For example, a photographic film called *microfilm* enables librarians to store information in small spaces. Microfilm contains reduced images of magazines and other materials, which can be viewed at their normal size on a projector. It is now possible to reproduce a 400-page book on a *microfiche,* a sheet of microfilm about the size of a playing card (see **Microfilm**). Some compact discs, called *CD-ROM's,* also save storage space (see **Compact disc**). *CD-ROM* stands for *C*ompact *D*isc *R*ead-*O*nly *M*emory). A CD-ROM stores about 250,000 pages of printed text, which the user can view on a computer screen. The entire text of *The World Book Encyclopedia,* for instance, easily fits on one compact disc.

Computers are an important technological advance for librarians. Computers keep records of various activities, such as ordering, cataloging, and circulating materials. Many libraries have computerized information sources called *online databases.* The person using an online database requests information from a central computer system, which may be thousands of miles from the library. The central computer sends the information over telephone lines to the library's computer. Online databases enable users to find articles, reports, and materials that libraries might not have in their collection. Other advanced systems, called *videotex* (a type of interactive video), combine computers, television, and telephones. Videotex permits libraries to offer various services in homes.

Some libraries join a *library network* to deal with the growth of information. In a library network, computers at different libraries are connected so that they share catalogs, materials, and services. For example, a patron might use the library network to locate a certain book about Latin American literature. The user can then request an interlibrary loan of the book or a photocopy or fax of certain chapters. In addition, the user can have an electronic version of the book sent over the library network.

Some networks serve many libraries. The OCLC (Online Computer Library Center) in Dublin, Ohio, has about 15,000 participating libraries. Other networks serve only a certain kind of library, such as a research or academic library. However, many networks are organized around a specific geographical area. Libraries throughout New England, for example, participate in the New England Library Information Network.

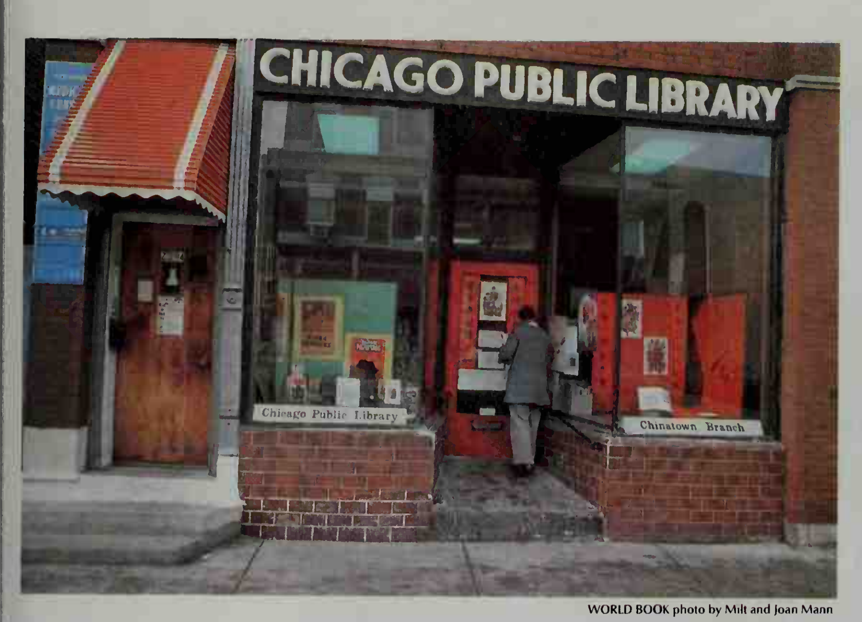
Some *Internet libraries* provide electronic versions of books, called *e-books,* that can be accessed by computer. NetLibrary is a leading Internet library. Internet libraries are also called *electronic libraries* or *e-book libraries.*

Finances. Libraries today face many financial problems. In many countries, public libraries and public school libraries receive most of their funds from taxes. Local taxes are the traditional source of funds, though state and federal governments also have contributed to the development of these libraries. Other libraries are privately supported by the organizations that run them and by private donors.

The funds available from both public and private sources are limited, and all libraries work within budg-

© Rich Skopin, Online Computer Library Center

A library network helps librarians deal with the rapid growth of information. Networking allows different libraries to share catalogs, materials, and services via computer. These people are using computers connected to the OCLC (Online Computer Library Center), a large library network.



Storefront libraries are one of the several ways that libraries have spread their services. Such libraries as the one at the left enable people to obtain library materials in their own neighborhoods.

WORLD BOOK photo by Milt and Joan Mann

ets. Rising costs for salaries, materials, and equipment, along with increased demands for library services, put a severe strain on library budgets. The librarian's job of choosing the best available material and the most useful services for a library thus becomes increasingly difficult. In addition, all libraries—whether their funds come from public or private sources—must compete with other institutions and other parts of society for the available funds.

Security. Each year, libraries lose large amounts of valuable materials through theft. Some libraries have adopted security systems to fight this problem. Under one such system, people leaving a library are required to pass through a turnstile at which a guard is stationed. The guard tries to detect anyone who is leaving the library with material that has not been checked out. Some libraries use electronic and magnetic devices to detect attempted theft. Substances that are sensitive to electric or magnetic impulses are put into library materials. If a person tries to leave the library with an item that has not been checked out, the substance sets off an alarm at the library exit.

Photocopying. Many people only need parts of books, magazines, newspapers, and pamphlets. Photocopying is a valuable aid to librarians and library users because it enables them to make copies of these materials. For example, people doing major research projects may need material from parts of dozens of books. These people can make copies of the information they need from each book. The device most commonly used to make photocopies is the *electrostatic copying machine* (see **Copying machine**).

Copyright law regulates the reproduction of published material by photocopying. In the United States, as in most other countries, the law provides for some photocopying by libraries or users without permission from or payment to the holder of the copyright. The copyright rules forbid copying of published materials in an attempt to avoid buying them. But copyright law does allow a limited exchange of photocopies among members of a library network or system, as long as such sharing does not deprive the publisher of sales. Some librarians believe that these photocopying restrictions hamper public use. Publishers respond that people may do any amount of photocopying they wish if they obtain permission and pay a fee to the holder of the copyright.

Censorship. The question of censorship is one of the most sensitive problems of librarians in the United States. Some people believe that certain material should not be published, and, if published, should not be available in a library. Such materials include many works dealing with religion or sex and works that promote such political or social views as Communism and revolution. Other people oppose all censorship. They maintain that censorship takes away the right to free expression and keeps people from developing creative ideas. Librarians often receive bitter complaints from procensorship people for deciding to acquire certain works, and from anticensorship people for excluding certain works.

Aging books endanger many important library collections worldwide. Many libraries today have large numbers of books made from wood pulp paper, which some publishers have used since the 1850's. Wood pulp paper produces acid that causes books to age quickly, making pages so brittle that they crumble when someone touches them. Between one-fourth and one-third of all books in U.S. research libraries are in this brittle condition.

Librarians, library organizations, and other groups work to save the information in fragile books. In some cases, librarians transfer information onto more permanent records, such as microfiche or photocopies. Scientists are developing methods to remove acid from paper, and librarians try to educate book publishers on the risks of wood pulp paper.

Public libraries



WORLD BOOK photo

The children's section of a public library is designed especially for young patrons. Colorful posters, a gingerbread playhouse, and furniture made for children, *left,* may help attract youngsters to this department. Librarians use many methods to make public libraries appealing to all members of a community.

Public libraries serve a far wider range of patrons than do all other kinds of libraries. These libraries aim to serve all members of a community, including children, young adults, and senior citizens. People use public libraries for schoolwork, their jobs, and for leisure-time activities. Public libraries must therefore store a variety of books and other materials and provide many services for members of the community. Many also must employ staff members who specialize in serving various age groups.

Kinds of public libraries. Public libraries range in size from huge big-city libraries with dozens of branches to small-town libraries that occupy only one room. There are about 15,000 public libraries in the United States. Of these, about 40 percent are branch libraries of a city, county, or regional library system. No matter what their size or where they are located, all public libraries have the same goal—to be of maximum service to their community.

To meet the needs of a large urban area, a big-city library must have a vast variety of books and other materials. It also needs branch libraries to serve people in their own neighborhoods. For example, the New York Public Library has about $14\frac{1}{2}$ million volumes and about 80 neighborhood branch libraries.

The materials in most large public libraries are organized into subject areas, such as history, science, and sports. These libraries also have special sections for children, adults, and, often, young adults. In addition, they may have specialized departments to serve the research needs and the industrial and scientific interests of the community. For example, the Detroit Public Library, located in a major automobile manufacturing center, has a large collection of materials devoted to automotive history.

Except in big cities, a public library does not have to be large to serve its community. A small library housed in a room or two can play an effective role if it has a good basic collection of reference books, subscribes to magazines of use to its patrons, and purchases enough new materials to keep up to date. But the essential element in any library is a librarian who makes it an active service institution and cares for both library materials and the people who use them.

Services for children. A good children's librarian makes the public library an exciting place. The librarian's friendly, understanding attitude can make the children's department fun and interesting. The librarian arranges the department so young patrons can use it easily. Desks, chairs, tables, shelves, and water fountains are at convenient heights for children, and the room may have posters and other colorful decorations that make it warm and appealing.

The children's librarian may conduct story hours, book clubs, and other activities to help young patrons enjoy themselves and develop an interest in the library and its materials. The librarian may also work with parent and community organizations, nearby schools, and other groups to establish programs for the education and recreation of children. Summer programs keep children interested in books and other materials during vacation.

Services for young adults. Librarians know that teen-agers need special attention because they have different needs and interests than children or adults. Some large public libraries have separate departments for young adults. Here, the librarian helps teen-agers continue to develop reading interests that will carry over into adulthood.

Young-adult departments feature materials on ca-

reers, sports, travel, and other subjects that teen-agers might find interesting. Teen-agers are especially interested in social issues, including citizenship, political change, pollution, and poverty. As a result, librarians try to obtain a wide variety of materials dealing with these subjects. Librarians in young-adult departments, as well as in children's departments, must be able to guide users to suitable books in the library's other departments when necessary.

Librarians for young adults, like those for children, conduct programs to encourage library use. Such programs might involve discussions of books, films, popular music, and current social issues that young adults find particularly interesting.

Services for adults. The needs of adults, like those of children and young adults, change and expand constantly. Developments in every field of knowledge make it increasingly important that adults continue their education after leaving school. Public libraries can play an important role in adult education. In addition, the public library is an important source of materials for leisure-time activity.

A public library maintains a wide selection of books for adults. The selection should include up-to-date reference works, such as almanacs, atlases, encyclopedias, and government publications. The selection should have nonfiction works that cover the whole broad range of people's interests as well as fiction of the past and present.

Many adults make use of the other services that public libraries offer. They can search the back issues of magazines and newspapers to find articles on specific subjects. For example, a librarian might help a family research a car that it wants to buy. Public libraries in the United States also provide tax forms and other information from the government. In some states, public libraries provide voter registration. Many public libraries lend videotapes, tape recordings, sheet music, and paintings. Reference librarians often help patrons answer specific questions.

Services for special groups. Public libraries have always served the needs of special groups, such as disabled persons. For example, many libraries distribute braille books to the blind. Talking books help individuals who cannot use regular books because of blindness, paralysis, or other disabilities.

Libraries are paying increasing attention to the needs of senior citizens. Many people nearing retirement turn to a library for help in planning their future. They seek information on recreation, health, travel, and handling finances. Librarians prepare booklists for senior citizens and may hold meetings where older persons can discuss their interests and problems. Most public libraries make books in large print available to people with failing eyesight, which is a problem for many elderly people.

In addition to providing materials and services, some libraries help special groups in other ways. For example, a library may have a ramp at an entrance instead of stairs so that people who use wheelchairs and anyone else who has difficulty using stairs can enter and leave the library easily.



WORLD BOOK photo

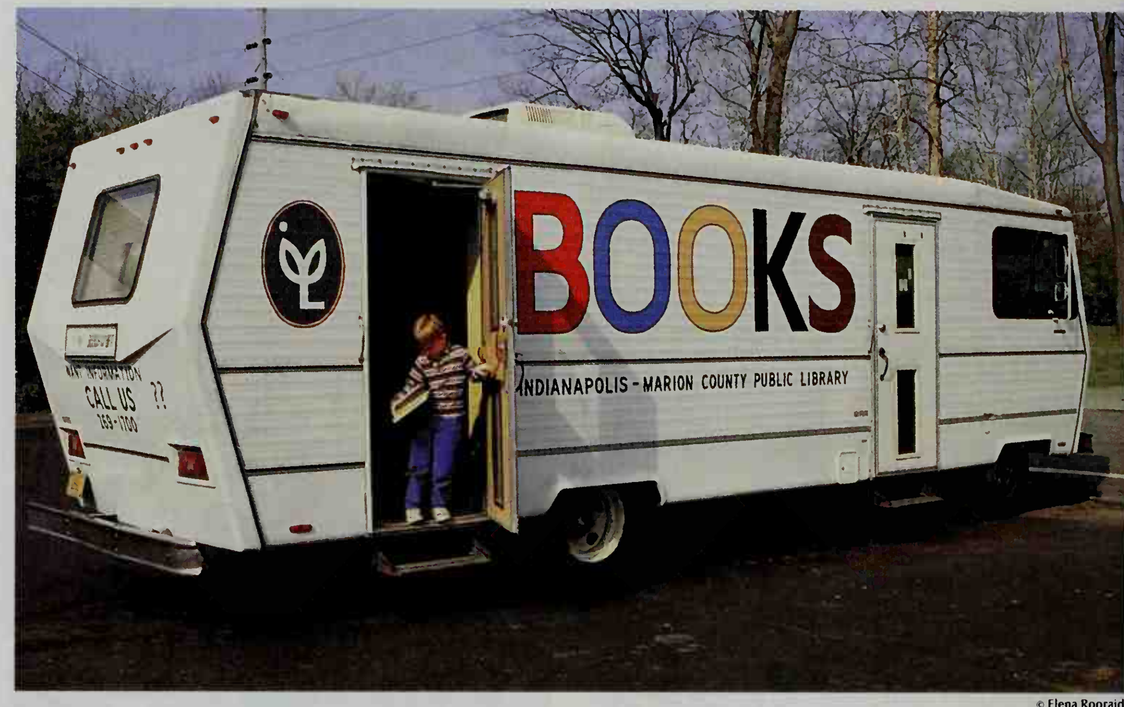
A reading lounge in a public library has comfortable chairs for patrons who want to browse through a recently published book or catch up on the latest issue of their favorite magazine.



WORLD BOOK photo

Reference librarians, such as the man shown above, are frequently called on to help patrons locate information. Some librarians conduct research to answer questions.

A good public library can become an information source for many groups in a community. Librarians may conduct film programs, group discussions, talks on library materials, and other activities for various community organizations. A public librarian might prepare a booklist to help members of a particular organization learn more about their cause. Organizations often hold meetings at public libraries. Many public libraries make a special effort to provide materials on education for teachers. Public libraries also have helpful resources for people seeking work. Business and industrial groups may do research at libraries. In addition, many libraries provide books for adults who are learning English or learning to read.



© Elena Rooraid

A bookmobile is a buslike motor vehicle used to bring library materials to people who may not be able to visit a library. Many public libraries operate such "libraries on wheels."

Spreading the service. A major goal of public librarians is to make their services available to everyone. Bookmobiles and branch libraries help spread public library service. Many libraries use cable television to provide services to people who cannot visit the library, such as senior citizens. As another step toward this goal, libraries might participate in library networks or interlibrary loan systems. Networks and systems, discussed in the section on *The library today,* have made important contributions to the distribution of services and materials.

Large libraries try to help smaller ones provide a wider range of services. For this reason, counties and regions often have their headquarters library in the county seat, which is frequently near many small-town libraries. The headquarters library places books in small-town libraries—and even in grocery stores and gasoline stations in areas that lack libraries. A headquarters library—and other public libraries as well—may also deliver books by mail or messenger.

Administering a public library, like managing any complex organization, requires skill, experience, and the ability to deal with people effectively. A director heads the staff of a public library. The director is responsible to the board of trustees, the group that sets policies for the library. In places that have no library board, the director may be responsible to the top government official of the community.

Most public libraries in the United States are administered by boards of trustees that consist of business executives, civic leaders, and other interested citizens. Voters elect most library boards. However, some boards are appointed by a local government official, such as the mayor.

The director has the responsibility of carrying out the policies set by the library board. In practice, the director often takes the lead in suggesting policies to the board. For this reason, the director and the members of the board must have confidence in one another.

The director also prepares the budget for the library, for approval by the board and the local government. After the budget has been established, the director makes sure the money is spent wisely and in accordance with the policies set by the board.

The director is responsible for the public relations of the library. The director tries to interest the public in the library through newspaper articles, radio interviews, television programs, and other publicity. The director also guides the library staff in the selection of library materials. Another important duty of the director involves dealing with procensorship and anticensorship groups.

A large public library may have separate departments for adult services; young-adult services; children's services; extension services, including branches and bookmobiles; technical processes, including ordering and cataloging library materials; services to special groups, such as immigrants and elderly people; audio and visual materials, such as videotapes or compact discs; public relations; personnel; maintenance; and business, including bookkeeping and other office functions. In a small public library, all of these duties may be the responsibil-

ity of the director and a few assistants.

Supporting the public library. Public libraries, like all institutions, must have adequate funds to be able to serve the community. In the early 1990's, public libraries in the United States typically spent between $15 and $35 a year for each person in their communities. Some libraries spent much more, and some libraries spent much less.

Salaries for librarians and other personnel make up the largest part of a library's budget. A public library may spend about 55 percent of its annual budget for salaries, 15 percent for new materials, and 30 percent for maintenance and miscellaneous expenses. Rising costs of operation have forced cuts in budgets for new materials and a decrease in service hours at many public libraries.

Local taxes are the chief source of money for public libraries. Some cities set aside money for the library out of their general funds, and others collect special taxes for the library. A few public libraries receive money from private sources.

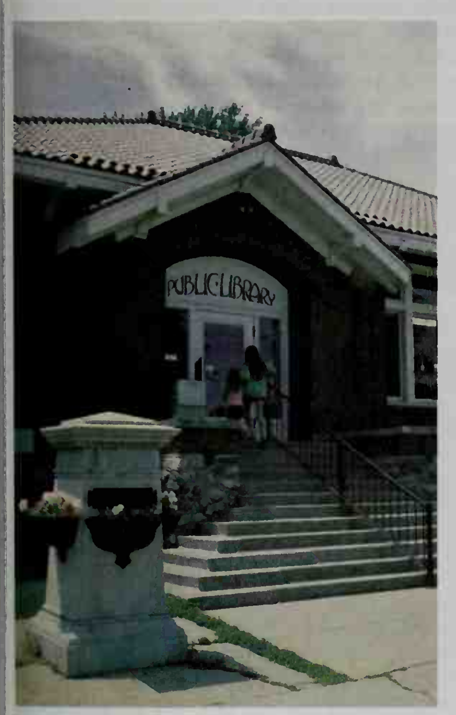
Private citizens also aid public libraries in other ways. Many communities have a local group, usually called Friends of the Library, that helps raise money for the library and acts as a public relations channel for it. Such citizen groups work to publicize or supply library services and to remind the public of the importance of the library to the community.

The public library must compete for funds with other important public institutions in a community, such as the fire, police, and sanitation departments. Some communities do not have—or do not set aside—enough money to provide adequate library service.

The state and federal governments have taken steps to help libraries meet their increasing financial needs. Some states supplement local library budgets with state funds. The state may provide funds to a well-organized local library so that it can serve a larger number of communities in its area. In this way, smaller communities can have the advantages of services provided by large public libraries.

The United States government is becoming increasingly important in helping public libraries. In 1956, Congress passed the Library Services Act (later changed and renamed the Library Services and Construction Act) to improve library service in rural areas. The government agreed to provide as much as $\$7\frac{1}{2}$ million in annual grants to the states for five years on a matching basis. Major amendments to the Library Services and Construction Act in 1964, 1966, and 1970 provided aid to both urban and rural libraries.

In the early 1990's, funds provided by the federal government under the Library Services and Construction Act totaled about $130 million a year. The act gives grants for increasing services to prisoners, the elderly, and other special groups. The act also grants money for the purchase of library materials and the development of interlibrary loan systems.



WORLD BOOK photo



Straub, Van Dine, Associates, Architects

Public libraries of all sizes and designs can be seen throughout the United States. The traditional style of many libraries of the late 1800's and early 1900's is shown at the left. More modern libraries, such as the one at the right, have been built since the mid-1900's.

School libraries



© Robert E. Daemmrich, Tony Stone Images

A school library complements classroom studies and offers a wide variety of educational materials to students and teachers. In the high school library shown above, small groups of students can work together at separate tables. The libraries in some large high schools include separate departments for languages, mathematics, science, and social studies.

School libraries are essential to the teaching and learning activities of a school. Teachers need resources that will help them improve classroom instruction. Students must be able to find materials that will answer questions on homework or in research projects. The quality of a school, to a great extent, depends on the availability of a good school library.

School libraries serve as centers for a wide variety of educational media. Publications include books, magazines, and newspapers. Audio and visual materials include games, tape recordings, maps, photographs, videotapes, and *realia* (real objects). Most school libraries have some electronic equipment, such as computers, tape recorders, videotape recorders, and film projectors. Because school libraries contain these various media, some people call them *school library media centers.* Others refer to school libraries as *learning resource centers* or *instructional materials centers.*

The media available in libraries—and assistance from school librarians—enable students to learn at their own pace. A student may type an essay using a computer or create a video presentation for a history project. Teachers often assign projects that involve slides or videotapes to make learning more exciting.

School librarians are sometimes called *media specialists.* They select materials for the library and help students and teachers effectively use its resources. For example, a school librarian might guide a student to books useful for a particular assignment. In addition, the librarian might teach the student how to use an on-line public access catalog of available materials. School librarians also help young people find enjoyable books to read in their free time. School librarians should have specialized training in librarianship. They should also have teaching skills, because school librarians work closely with educators.

Many school systems provide services for their libraries. For instance, a school system may hire a school library supervisor to plan media programs in individual libraries. The supervisor might coordinate the placement of advanced technology in school libraries, such as on-line catalogs and library networks.

Elementary school libraries provide many children with their first chance to use and enjoy a library. Children come to the library to browse, borrow materials, listen to stories, and find information for hobbies or classroom assignments. In the past, young children did little library research. But many schools today rely on materials in their libraries to develop creativity and reasoning skills in young students.

A good school library provides a wide range of material for students and teachers. If a fifth-grade class is studying Mexico, the teacher can borrow photographs on Mexican life and compact discs of Mexican music. The teacher may instruct the students to research Mexico at the school library, encouraging them to explore, discover, and locate materials. In the library, the students may also work together in small groups to discuss their research or watch videotapes. Some libraries have separate rooms for group activities.

Middle school and junior high school libraries serve students who are growing out of childhood and into their teens. These libraries try to keep alive the enthusiasm that younger students bring to ideas, information, and materials. To do this, librarians expand their collections to fit many interests and abilities.

Teachers in middle school and junior high school commonly assign more independent and small-group research projects than do teachers of lower grades. For this reason, libraries that serve higher grades cover a wider variety of subjects. Middle school and junior high school librarians work with students to help them locate and analyze materials. Of course, school librarians continue to find good books for leisure-time reading as students grow older.

High school libraries differ from elementary, middle, and junior high school libraries in two chief ways. Most of them are larger than other school libraries because high schools usually have more students. High school libraries also cover a more complex range of subjects than libraries for lower grades. A library in a large high school might have separate departments—sometimes called *resource centers*—for languages, mathematics, science, and social studies.

In high school, students work on more research and independent study projects than in lower grades. These skills are important for students who plan to enter college after graduation. High school librarians make sure that students know how to find materials using a wide range of resources, including advanced technology. For example, high school libraries may store information on CD-ROM's. Students can look up the information using a computer. Some high school libraries have studios for making films or audio recordings.

Many high schools have library clubs. Members of these clubs may assist in the work required to run a library, such as selecting materials or entering new books into a catalog. Club members may also read aloud to younger students or tutor them in writing skills.

Families and local businesses often become involved in high school libraries. Parents may volunteer to help students find information in the library. In addition, many schools provide library cards to entire families and offer extended weekend and evening hours. Local businesses may supply free computers and teach classes on using new technology.

School library standards. Many schools have good libraries, though many others do not provide enough facilities. In the United States, some public elementary schools do not even have a central library. In these schools, library books are kept in the classrooms. Other schools have libraries but lack the money for purchasing up-to-date materials or employing a librarian.

Librarians and other educators have long called on schools to meet certain library standards. In the United States, various states and associations set library standards. The American Association of School Librarians and the Association for Educational Communications and Technology have outlined standards for school libraries in *Information Power: Building Partnerships for Learning* (1998). These standards explain the kinds of materials that school libraries should have. The standards also stress the need for open communication between librarians, teachers, and administrators.

The U.S. government grants money for the improvement of school libraries. The National Defense Education Act of 1958, the Elementary and Secondary Education Act of 1965, and the Higher Education Act of 1965 provide funds for library resources and education for librarians. However, many people point out that government funding has not kept pace with the rising costs of the technology used in libraries.



WORLD BOOK photo

Books written in Spanish are part of the collection of the library in a community that has a large Spanish-speaking population. Many school libraries have such foreign-language books and other materials to help meet the needs of their patrons.



WORLD BOOK photo

Realia, or actual objects, are available for study in some school libraries. Such materials provide students with additional aid in their schoolwork. The boy shown above has checked out several birds' nests to examine while he reads a book on the subject.



Ezra Stoller

A rare-book collection is an example of the vast and valuable holdings of university libraries. The collection shown above is part of the Beinecke Rare Book and Manuscript Library at Yale University. The six-story glass enclosure contains about 180,000 rare volumes.

College and university libraries. The library is a major resource of any modern institution of higher education. College students study such a vast, fast-changing body of knowledge that few courses can be taught with one, two, or even half a dozen textbooks. Research occupies a significant place in life at colleges—both two- and four-year schools—and at universities. The library has a vital role in this search for knowledge. It serves as a workshop for the entire college or university, students and faculty alike.

In the early 1990's, the United States had about 3,300 college and university libraries. These libraries owned about 717 million books, employed about 100,000 staff members, and spent about $3\frac{1}{4}$ billion annually. Canada had 365 college and university libraries. The world's largest university library system, with more than 12 million volumes, is at Harvard University.

A college or university library is a complex institution. It must have large quantities of materials to meet the demands of both students and faculty. Such materials include books, magazines, newspapers, videotapes, and photographs. Many university libraries have collections that are devoted to highly specialized subjects. For example, the libraries on the various campuses of the University of California have special research collections on astronomy, oceanography, California history, citrus fruits, east Asia, early English literature, and Latin America. Other university libraries have separate buildings for rare books or original manuscripts.

A large university may have as many as 50 or more libraries in various departments, schools, and branches. An entire library may be devoted to a single field of study, such as biology, education, music, or psychology. Such specialization of libraries helps students locate in-depth materials on major courses of study.

Since the 1960's, however, colleges and universities have moved away from highly specialized libraries. Many libraries today cover broad areas, such as the physical sciences or the humanities. These libraries enable students and professors to find information in various related fields. For example, a music student can easily research the historical events during a particular musician's career in this type of library.

College and university libraries must make new information immediately available to their patrons. But information increases faster today than at any other time in history. For this reason, college and university libraries have expanded their storage space to accommodate new materials. Many schools have rebuilt their libraries to hold more books than before. In addition, libraries may have magazines and newspapers stored on microfilm instead of in large volumes. Most college and university libraries use computers to keep track of the vast amounts of information they collect.

In the past, many university libraries devoted their attention to the needs of graduate students and faculty. Undergraduates often lacked resources for their studies. However, an explosion of college students since the 1950's has resulted in more library resources for undergraduates. Many universities have built separate libraries for undergraduate students.

Research libraries. Many libraries collect materials that will support the needs of scholars and other advanced researchers. Some research libraries have information on the newest scientific findings worldwide. Others contain original manuscripts of early literary works. Research libraries may be a part of colleges or universities. But independent and government libraries also serve as research libraries.

Some of the most famous research libraries function as independent institutions. The Pierpont Morgan Library in New York City specializes in fine arts and in early printed books and manuscripts. The Folger Shakespeare Library in Washington, D.C., has one of the world's great collections on the Elizabethan period of English history.

Other private research libraries include the Newberry Library in Chicago, which specializes in history, literature, and the fine arts; the Linda Hall Library in Kansas City, Mo., specializing in science and technology; and the Henry E. Huntington Library in San Marino, Calif., which is rich in literature, early printing, and the fine arts. Some business organizations also administer independent research libraries.



Normunds Berzins, Image Finders Photo Agency

The John P. Robarts Research Library at the University of Toronto is one of the largest academic library buildings in North America. It houses humanities and social sciences collections.

Many government libraries have outstanding collections of materials for research. In the United States, government libraries include the Library of Congress, the National Library of Medicine, and the National Agricultural Library. These libraries are discussed in the *Government libraries* section of this article. Most public libraries do not aim to support scholarly research. But some have collections that are helpful to scholars, such as the Cleveland Public Library's collections on folklore and on Asian history. Many scholars also use the New York Public Library and the Boston Public Library for their research.

Research libraries face a variety of challenges. They must continue to provide in-depth resources to researchers as the amount of information rapidly increases. About 1,000 books are published each day throughout the world. In the United States, more than 9,000 magazines are published annually. In addition, books and magazines for researchers have become much more expensive. For example, a book that cost $5 in the 1960's might cost $20 today.

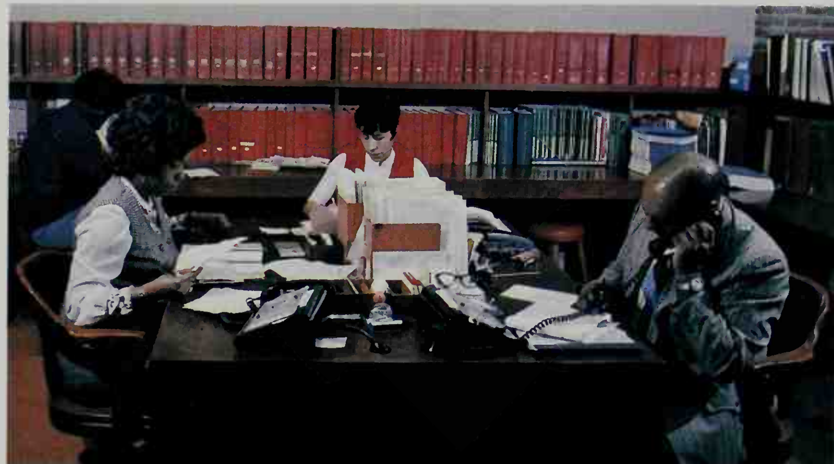
No one library can own all the material that researchers might request. Researchers often need rare, out-of-print books and materials published in foreign languages. Some researchers use letters or other original documents written by important people. Researchers must keep up with the latest research and discoveries by using advanced technology, such as on-line catalogs or CD-ROM's. To serve as many scholars as possible, research libraries cooperate in sharing, purchasing, and storing materials.

Shared catalogs enable scholars to find the libraries that carry a particular document. The Library of Congress publishes the *National Union Catalog,* a list of books, maps, pamphlets, magazines, and other works in more than 1,000 Canadian and U.S. libraries. Many libraries also share catalogs over computer networks. A researcher who finds materials at another library can request an interlibrary loan.

Libraries also cooperate in buying books and other research materials. For example, the Library of Congress operates a variety of overseas offices and programs for acquiring foreign publications. Some research libraries also cooperate in housing valuable but seldom-used books. The Center for Research Libraries in Chicago serves as a storage center in the United States. The center also subscribes to thousands of rarely used journals and government documents, which member libraries may borrow.

Many libraries join organizations to help them face the challenges of maintaining and organizing research collections today. For instance, 119 Canadian and U.S. libraries belong to the Association of Research Libraries. The association helps research libraries identify key problems and develop cooperative solutions to these problems. The group also works to save the information in fragile, aging books, which are an important part of today's research collections (see the *Aging books* section of this article).

Government libraries



United States Department of Agriculture

Government libraries serve the reference needs of government officials. The National Agricultural Library also aids the agriculture industry of the United States and other users. Researchers in the library's telephone inquiry department, *shown here,* answer questions on agricultural topics.

United States government libraries. Every department and many agencies of the United States government maintain their own libraries to help their staffs. Three government libraries have such large and varied collections—and provide such wide-ranging services—that they are considered *national libraries.* These three libraries, all located in or near Washington, D.C., are (1) the Library of Congress; (2) the National Agricultural Library of the Department of Agriculture; and (3) the National Library of Medicine, in the Public Health Service division of the Department of Health and Human Services.

The Library of Congress is probably the largest library in the world. This enormous center of information contains about 120 million items, including books, journals, music, films, photographs, and maps. Since 1870, the library has received two free copies of every book that is copyrighted in the United States. The U.S. Copyright Office is a department of the Library of Congress. For more information on the library, see the **Library of Congress** article.

The National Agricultural Library was founded in 1862 to serve the Department of Agriculture. The library now has a wide range of users, including universities, government agencies, chemical and drug companies, and the agriculture industry. The library's collection of more than 2 million items includes materials on agricultural engineering, soils, and other fields of agriculture. It also has materials on biology, chemistry, and home economics. The National Agricultural Library prepares the monthly *Bibliography of Agriculture,* which lists articles in the library's collection.

The National Library of Medicine collection includes about 5 million items in nearly all written languages. The collection serves physicians, nurses, students, researchers, medical schools, and libraries in many parts of the world. The library's monthly publication, *Index Medicus,* lists articles from more than 3,000 medical journals by subject and author.

The National Library of Medicine has one of the most advanced computer systems for information processing in the world. This system is called MEDLARS, a name that stands for *Med*ical *L*iterature *A*nalysis and *R*etrieval *S*ystem. MEDLARS enables the library to compile and publish bibliographies on medical subjects electronically. MEDLARS also includes about 40 computer databases. MEDLINE is the best known of these databases. Physicians, scientists, medical librarians, and other users worldwide can access it to search for information in *Index Medicus.*

Some large federal agencies operate library systems on a nationwide and worldwide scale. The largest of these systems are those of the Army, Navy, and Air Force. Each military organization places libraries on its bases worldwide to provide technical information and leisure-reading materials. The Navy also has libraries on its ships.

The Department of Veterans Affairs operates libraries in many of its more than 170 hospitals. These libraries, run by medical librarians, serve the medical staff, and some include materials for educational and recreational use by patients.

The National Archives is a government agency with a library that stores valuable records of the U.S. government, including such documents as the Declaration of Independence and the U.S. Constitution. Most U.S. presidential libraries are part of the National Archives (see **National Archives**).

In addition, the U.S. Department of State is responsible for operating *information resource centers* in more than 100 countries. Thousands of people visit these centers each year to find information about the United States.

There are more than 2,400 other federal libraries. Each of the executive departments of the U.S. government has an outstanding collection devoted to special fields related to the department's work. Other important libraries include those of the National Institute of Standards and Technology, the National Weather Service, the Office of Management and Budget, the Patent and Trademark Office, and the Environmental Protection Agency. The Smithsonian Institution has several libraries, which

cover subjects ranging from air and space travel to the history of technology.

The Federal Library and Information Center Committee, established in 1965, coordinates all federal library activities. The committee has its headquarters in the Library of Congress. Its membership includes representatives from the national libraries and the federal library community. The committee tries to make sure that the services provided in the U.S. government libraries meet the needs of the nation.

State libraries. Most states have a state library. These libraries are agencies of the state governments, and their primary function is to make materials available to government officials. The libraries also provide materials to other libraries in their states. In addition, a state library plans—in cooperation with library leaders throughout the state—a statewide library program for the benefit of all citizens. The amount of service provided by state libraries varies among the states, of course. But most well-established state libraries share similar characteristics.

Service to government. A state library serves the state government in many ways. State officials use the library as a general library and information center. The state library will provide research for state officials on any subject. This function is known as *legislative reference and research service.* The state library agency may maintain a special law library, which serves as the state center for legal reference and research. The law library furnishes judges, legislators, and other officials with information on government, laws, and political science.

A state library agency may maintain other special libraries in such fields as the humanities, medicine, the physical sciences, the social sciences, and technology. Special libraries of this kind are gaining increasing importance as governments take on a wider range of responsibilities. Today, government officials may need detailed information on almost any subject to help them reach decisions on many complex issues.

Service to other libraries. State libraries are sometimes called *librarians' libraries.* This term reflects the state library's role of serving other libraries in the state. For example, a state library may function as the center of a state's interlibrary loan system. The library may supply public, school, college, and university libraries with seldom-used and costly materials from the state collection. It may also offer technical and advisory assistance to these libraries, and gather statistics on libraries in the state.

State libraries work to provide quality library service for all citizens in their states. Since the 1960's, one of the chief ways by which state libraries have promoted good statewide library service has been through library cooperation. Programs include creating library systems, organizing resource centers, and encouraging all types of libraries in the state to work together.

State libraries also serve as links between the state's public, school, and college libraries and the state and federal governments. State libraries may propose legislation designed to benefit libraries, and they administer funds set aside by the federal government under the Library Services and Construction Act. State libraries also administer funds that state governments provide for public libraries.

Other services. State libraries work with other agencies for library improvement. These agencies include the American Library Association, the United States Department of Education, and the Council of State Governments. State libraries also coordinate the recruitment of librarians in their states and work with library educators in planning academic programs to train professional librarians. State libraries also conduct in-service training for librarians and library trustees to help keep them aware of new developments in librarianship.

State libraries collect and preserve official state records and documents and maintain collections of material on state history. They compile and distribute lists of state publications and distribute state documents to other libraries in and outside their states. Many state libraries receive braille and talking books from the Library of Congress and loan them to blind and partially sighted people in their states. In some states, the state library offers books and other library services to inmates of correctional and other institutions.

State libraries have also assumed a leadership role in the development of a national system of libraries. This role calls for the eventual coordination of the resources available in all types of libraries throughout the United States.

Canadian government libraries. The Canadian government maintains the Library of Parliament, the National Library of Canada, the Canada Institute for Scientific and Technical Information, and about 310 other libraries that serve government departments and agencies. The main government libraries are in Ottawa, the national capital.

The Library of Parliament, like the Library of Congress, was established chiefly to serve the needs of its country's lawmakers. The library—which houses about 640,000 volumes—now serves many other needs, including those of scholars. The Library of Parliament has served the Canadian government ever since the formation of the Dominion of Canada in 1867. The library evolved from the legislative libraries of Lower and Upper Canada, two political units that were created out of the old province of Quebec in 1791. After Lower and Upper Canada united in 1840, the two libraries became one. This library became the basis of the Library of Parliament.

The National Library of Canada began operations in 1953. It houses about $9\frac{1}{2}$ million books and other items, most of which deal with Canada. The National Library publishes *Canadiana,* a monthly and annual list of new books and pamphlets about Canada. Another service of the National Library is the *Canadian Union Catalogue,* which lists material in about 300 Canadian government, public, university, and special libraries.

The Canada Institute for Scientific and Technical Information was founded in 1916 as the National Science Library. This library has about $2\frac{1}{2}$ million books and other items and houses the government's collections on science and technology. The institute also serves as the center of a national information network on science and technology.

Special libraries



WORLD BOOK photo

The collection of a special library may feature items other than books. The map library shown above, for example, has thousands of maps for the use of its patrons.



WORLD BOOK photo

A special library at the United Nations, *above,* provides delegates with materials on international law, economic and social affairs, and other subjects related to UN work.

Many businesses, associations, and other organizations maintain a library to serve the special needs of their workers and members. Such libraries fall into the general category of special libraries. They have a variety of names, including *information center, division of information services, research center library,* and *technical library.*

The library of a newspaper is a special library. So is the library of a bank, of an advertising agency, or of a company that makes airplanes. *The World Book Encyclopedia* maintains a special library for the use of its editors and researchers. Many of the research and government libraries discussed elsewhere in this article are special libraries. There are probably more than 12,000 special libraries in the United States and more than 1,200 such libraries in Canada.

Special libraries range from tiny rooms to huge buildings. Some spend tens of millions of dollars each year providing library services. The contents of special libraries depend on the needs of the organization they support. For example, a pharmaceutical company's library deals chiefly with chemistry and the life sciences. In fast-developing fields, special library collections may include few books. These libraries may rely instead on journals, electronic resources, newspaper clippings, scientific papers, and research or government reports.

Most special libraries focus on helping their users keep up with rapid developments in a particular field of knowledge. Many of these users are professionals who need up-to-date information to make important decisions. An engineer, for example, may need to know the results of recent research before deciding how a new product should be made.

A special librarian must be able to provide the information required by the organization. To do this job well, the librarian must (1) be thoroughly familiar with the operations and needs of the organization, (2) know the contents of the library in detail, and (3) know where to turn for the information.

Most special libraries have little information on general topics. Therefore, special librarians make extensive use of other sources of information, such as on-line databases, government agencies, research libraries, and university libraries.

Many special librarians have training in both librarianship and a special subject. For example, the librarian of an art museum might have degrees in both art history and library science. Similarly, the librarian of a chemical company might have degrees in chemistry and in library science.

Special librarians are organized into an association called the Special Libraries Association. This association has about 13,000 members in the United States, Canada, and other countries. It is divided into various divisions, such as Nuclear Science and Education. The divisions of the Special Libraries Association enable people with similar interests to work together on common library problems.

Librarians draw on many fields of knowledge to help them in their work. One such field, called *information science,* deals with how information is created, organized, and applied. Information science also involves how people look for and use information with computers, compact discs, on-line catalogs, networks, and other technological developments. Librarians often study information science to find ways to improve library services. See also **Information science.**

Information science brings together ideas from many other fields, including technology, communications, information theory, linguistics, management, mathematics, and psychology. This wide variety of knowledge contributes to the operation of a library.

A few examples show how information science applies to libraries. Technology helps librarians design automated library procedures involving computers, telephone lines, and other advanced equipment. Communications provides an understanding of the various media that libraries can use to transmit information. Information theory, a branch of science and engineering, can be used to analyze the quality and characteristics of systems that transmit information. Linguistics helps librarians create catalogs and databases that provide access to information. Management supplies techniques for improving library operations. Mathematics provides a means to formulate exact statements of library problems. Psychology leads to a better understanding of how the human mind looks for, organizes, and finds information in a library.

Information science developed gradually during the 1900's. Today, most colleges and universities teach information science as part of their library, business, management, engineering, and computer science programs. Most schools of library and information science offer courses in information science. The large number of these courses indicates the field's importance to librarianship.

People who receive degrees in information science may work in a variety of fields, such as computer programming or market research. But many people who earn such degrees choose careers in library work. Some people who complete programs in information science hold research positions on library staffs. Others help libraries benefit from electronic developments by serving as technology consultants. For example, information scientists may design a library network to help patrons find information in other libraries. See the *Careers in library work* section of this article for more information on applying information science to the library field.

The American Society for Information Science (ASIS) has many librarians among its 4,000 members. The society publishes the *Journal of the American Society for Information Science,* which provides useful articles for people interested in the field. The journal features special sections on such topics as adding computers to university facilities or organizing networks for public libraries. The *Bulletin* of ASIS reports on new developments in the information field. ASIS also publishes the *Annual Review of Information Science and Technology,* which provides reviews of recent literature on information science and technology. Many other journals and publications have articles that apply information science and technology to library work.


Chicago Public Library



Computers help librarians provide information. Many librarians study *information science* so they can better assist computer users. The field of information science deals with how people obtain and use information from computers, compact discs, networks, and other sources. Many libraries employ special technology consultants.

Libraries of the world



Novosti Press Agency, Moscow

The Russian State Library (formerly the Lenin State Library), in the heart of Moscow, is the largest library in Russia and one of the largest in the world. This ornately decorated library houses more than 30 million items. It serves both as Moscow's main public library and as a national center for scholarship.

Western Europe has many of the largest, oldest, and most important libraries in the world. The national libraries of the United Kingdom and France—the British Library in London and the Bibliothèque Nationale de France in Paris—are world centers of scholarship. The British Library owns about 18 million books, and the Bibliothèque owns about 9 million.

In addition to national libraries, Western Europe has dozens of world-famous university libraries, including the libraries at the University of Paris and at Oxford University and Cambridge University in England. There are also many important special libraries in Western Europe. Several of them have notable collections of early manuscripts and books. Vatican Library in Vatican City, the central library of the Roman Catholic Church, is one such institution. Government libraries and libraries of industrial and research organizations operate throughout Western Europe.

The United Kingdom's public library system became well established during the late 1800's. But in most of the rest of Western Europe, public library systems did not develop until the mid-1900's. Today, there are good public library systems throughout the United Kingdom, Ireland, and Scandinavia. Many librarians consider Denmark's public library system as a model for the rest of the world. France and other West European nations have made much progress in improving their public library systems.

The development of library education in Western Europe has followed a pattern similar to that of the development of public libraries. Excellent library schools operate in the United Kingdom, France, Germany, and the Scandinavian countries. All except the smallest Western European nations have library associations and publish library journals.

Eastern Europe and Russia. The countries of Eastern Europe have a long tradition of scholarly libraries. The libraries of Charles University in Prague, Czech Republic, and of Jagiellonian University in Kraków, Poland, rank among the oldest in Europe. Both date from the 1300's. Each country of Eastern Europe has a national library. The National Library of the Czech Republic in Prague has a collection of about 6 million volumes. The Hungarian national library in Budapest owns about $2\frac{1}{2}$ million volumes.

Public libraries and reading rooms exist in large cities, small towns, and rural villages throughout Eastern Europe and Russia. Labor unions and workers' councils in industry also maintain library systems.

Libraries in Russia and the other countries that formerly made up the Soviet Union total about 330,000. About 130,000 of them are public libraries. The Russian State Library in Moscow (formerly the Lenin State Library) is Russia's largest library and one of the largest in the world. Its collections of books, magazines, and newspapers include more than 30 million items. The Library of the Russian Academy of Sciences in St. Petersburg (formerly the Library of the Academy of Sciences of the U.S.S.R.) has about 12 million volumes. The M. E. Saltykov-Shchedrin State Public Library in that city houses more than 28 million volumes.

Russia and the countries of Eastern Europe have library associations. Journals and programs in these countries help educate librarians.

The Middle East has a growing number of modern libraries. The region's largest library is the Jewish National and University Library in Jerusalem, Israel. The library's collection totals about 4 million volumes.

Other relatively large libraries in the Middle East include the national libraries of Turkey and Lebanon, and the libraries of the American University in Beirut, Lebanon; the University of Tehran in Tehran, Iran; and the University of Ankara in Ankara, Turkey. Saudi Arabia has four university libraries. Egypt, which is part of both the Middle East and northern Africa, has large national and university libraries (for more information, see the *Africa* section of this article).

Many Middle Eastern countries have developed public libraries. Modern and well-equipped libraries can be found in the major cities of Israel, Jordan, Oman, Qatar,

and Saudi Arabia. Various Middle Eastern universities offer library and information science programs. These universities include the University of Tehran in Iran, Hebrew University in Israel, Sultan Qaboos University in Oman, King Saud University in Saudi Arabia, and the University of Ankara in Turkey. Library and information science associations operate in Iran, Israel, Jordan, Lebanon, and Turkey.

Africa. Millions of Africans have no public library service. In some African nations, the only important libraries are those connected with institutions of higher education. Some countries do not have any locally supported public libraries. The lack of library service is most serious in the more than 30 nations that became independent during the 1950's and 1960's. However, some of these countries are developing public library services. They include Congo (Kinshasa), Côte d'Ivoire, Ghana, Kenya, Morocco, Nigeria, Sierra Leone, Tanzania, and Tunisia.

Most of the largest and more important libraries are in far northern or southern Africa. The Egyptian National Library in Cairo has over 1 $\frac{1}{2}$ million volumes, and the Cairo University Library has more than 1 million. Algeria has a university library that owns more than 700,000 volumes and a large national library that was rebuilt after a fire in 1962. The National Library of Tunisia has about 700,000 volumes.

The Republic of South Africa has several large libraries. They include the Johannesburg Public Library, with about 1 $\frac{1}{2}$ million volumes; the Cape Town City Libraries, with more than 1 million volumes; and the South African Library in Cape Town, with about 600,000 volumes. The libraries of the universities of Cape Town, Pretoria, and Witwatersrand house from 800,000 to 960,000 volumes each.

Africa has a few programs for educating librarians. These programs include those at the universities of Alexandria, in Alexandria, Egypt; Cape Town; Pretoria; Cairo; Ghana, in Accra, Ghana; Ibadan, in Ibadan, Nigeria; Ahmadu Bello, in Zaria, Nigeria; Dakar, in Dakar, Senegal; Makerere, in Kampala, Uganda; and Moi University in Eldoret, Kenya. Africa also has a number of library associations. These include associations in Egypt, Ghana, Morocco, Nigeria, South Africa, Tanzania, Togo, and Tunisia.



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Vatican Library, in Vatican City, has one of the world's largest and most valuable collections of early manuscripts and books. It is the central library of the Roman Catholic Church.

South and Southeast Asia. Most countries of South and Southeast Asia have national libraries and one or more university libraries. Most of the libraries are small and poorly supported.

The chief national libraries in South and Southeast Asia are those of India, Malaysia, Singapore, and the Philippines. The largest and best-developed university libraries are at the University of the Philippines; the University of Singapore; and the Indian universities of Allahabad, Delhi, Kolkata, Mumbai, Vadodara, and Varanasi. Most of the countries of South and Southeast Asia have scientific and commercial libraries, and many major government branches operate libraries.

Most of the free public libraries in South and Southeast Asia have been constructed since the 1940's, but many countries in the region have made little progress. One of the largest libraries in South and Southeast Asia is the Delhi Public Library in India. It has about 970,000 volumes. This library was founded in 1951 with the assistance of UNESCO, a United Nations agency, to provide an example of a modern public library.

Schools in many parts of South and Southeast Asia offer library training programs. These schools include Chulalongkorn University in Bangkok, Thailand; the University of the Philippines in Quezon City; the universities of Delhi and Madras in India; and the University of Karachi in Pakistan. Library associations operate in many of the countries of South and Southeast Asia.

Australia and the Far East. Australia has a well-developed library system. The National Library of Australia, in Canberra, has more than 4 $\frac{1}{2}$ million volumes. The country's largest university library is that of the University of Sydney. It has more than 4 million volumes. Each state has a state library in its capital. The largest is the State Library of New South Wales in Sydney, with about 3 million books and other items.

Australia has many governmental libraries, and other libraries that serve commercial, research, and industrial organizations. Almost every city and town in Australia has public and school libraries. Australia has a library association, a professional library journal, and several library schools.

Japan also operates a well-developed library system. The National Diet Library in Tokyo owns about 10 $\frac{1}{2}$ million volumes. It has more than 30 branches. There are more than 500 Japanese university libraries. The most important ones include the libraries of the universities of Hokkaido, Kobe, Kyoto, Kyushu, Tohoku, Tokyo, and Waseda. The largest of these libraries, the one at the University of Tokyo, has about 6 million volumes. Some public and school libraries operate in Japan. In some areas of the country, bookmobiles provide library services to factories.

Many Japanese universities offer library education programs, including the Japan Library School at Keio University in Tokyo. Japan has several library associations and a professional library journal.



Sven Doehner

The library of the Museum of Anthropology in Mexico City, *above,* owns many ancient manuscripts. This student is studying a manuscript to learn about early Mexican-Indian culture.

China has a growing library system. The great National Library in Beijing reportedly has about 16 million volumes, and the Nanjing Library owns about 6⅔ million volumes. Each province in the country has at least one central library, with collections ranging from 1 million to 4 million volumes.

Since 1949, when the Communists conquered China, dozens of universities, colleges, and technical institutes have been founded, all with libraries. The Communists have made efforts to bring books and libraries to the people through schools, factories, and some public libraries. The municipal library of Shanghai is reported to contain more than 8 million volumes.

The other countries of the Far East have also made progress in library development. The largest library of Taiwan is that of the National Taiwan University, which has about 1½ million volumes. South Korea has the 2 million-volume Central National Library, the 1⅓ million-volume Seoul National University Library, and the 400,000-volume Korea University Library, all in Seoul. Both Taiwan and South Korea have library schools and professional associations for librarians. North Korea has a large central library in Pyongyang.

Latin America. Libraries and librarianship have had a difficult time gaining recognition and support in most of Latin America. However, many countries have built national libraries and libraries for universities and other educational institutions.

The most important national libraries of Latin America operate in Argentina, Brazil, Chile, Mexico, and Peru. Each of these libraries has from 1½ million to more than 4 million volumes.

Large university library collections include those of the University of Chile; the University of Buenos Aires, in Argentina; and the Technological Institute in Monterrey, Mexico. Each collection is divided among several branch libraries.

Large numbers of cities and towns in Latin America have no free public library service, but several countries are making important gains toward that goal. Brazil has developed some of the best public libraries in Latin America. The São Paulo Municipal Library is especially noteworthy. Other Latin-American countries that have made significant advances in providing public library service are Argentina, Chile, Colombia, Panama, and Peru.

Most Latin-American countries have special schools to train librarians. These countries include Brazil, which has about 30 library schools, and Argentina, Chile, and Colombia. Almost all countries in Latin America have national library associations.

International library programs. Several international and national organizations work to improve libraries throughout the world, especially in developing countries. For example, UNESCO has helped upgrade libraries in developing nations.

The many UNESCO library activities have included the establishment of model public libraries in developing countries and of an inter-American library school in Colombia.

The Agency for International Development (AID) of the United States government administers the nonmilitary part of the U.S. foreign aid program. Part of the aid helps upgrade libraries and train librarians and information scientists in developing nations. Many other countries, including Britain, France, Germany, and Sweden, have agencies that perform similar functions for libraries in developing countries.

The American Library Association (ALA) maintains an international relations program. The association helps establish libraries and library schools in several countries. The ALA also coordinates many international library programs, such as the Library/Book Fellows Program. The program, administered with a grant from the United States Information Agency, enables U.S. librarians and publishers to teach modern library techniques abroad.

The International Federation of Library Associations and Institutions (IFLA) was founded in 1927 to promote international library cooperation. The IFLA has about 1,300 members and affiliates, representing more than 130 countries. The IFLA has made much progress toward unifying library procedures and standards. The federation also promotes understanding among the librarians of the world. The headquarters of the IFLA are located in the Netherlands. The IFLA publishes the quarterly *IFLA Journal.*

Several international associations promote cooperation among libraries that specialize in the same field. They include associations of agriculture, law, music, and school libraries.

A number of private foundations help the international development of libraries. For example, the American-sponsored Asia Foundation has worked to develop libraries in 17 Asian countries. The Ford Foundation has given financial support to develop libraries in Asia, Africa, and Latin America. Other foundations that provide financial support to libraries of various nations include the China Medical Board of New York and the Gulbenkian Foundation.

Librarians work in an important and rapidly growing field. They bring the knowledge of the past and the ideas that shape the future to people of all ages. Librarians also provide essential tools for the personal enjoyment and satisfaction of their patrons.

Careers for librarians. The library profession offers a wide variety of careers to fit the many kinds of libraries and library services. A librarian can work in any one of several kinds of libraries—public, school, college or university, research, government, or special. Other librarians choose to have related careers in nonlibrary settings. For example, librarians may work in the research department of a manufacturing company. Some librarians operate their own businesses, which provide information services for other companies. Librarians, especially those who work with information science, are sometimes called *information professionals.*

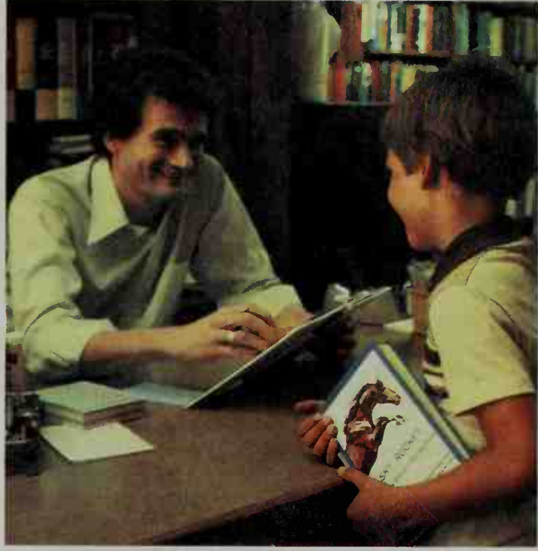
Librarians serve different kinds of people, depending on where they choose to work. Public librarians deal with children, students, professional people, and the general public. Librarians in colleges and universities help students, faculty, and scholars. Special librarians work with experts in particular fields. A librarian in a law library, for instance, might assist lawyers and legal assistants. Many librarians come into direct contact with patrons, and others work chiefly with computers and other technology.

Librarians perform various services for patrons. Libraries—whether large or small—acquire, organize, preserve, and communicate information. In small libraries, the librarian may handle all of these operations. In larger libraries, librarians divide their work into several jobs. For example, some librarians work as *acquisitions librarians,* who purchase materials. Others focus on new technology and the development of computer systems. Librarians may also work in administration. Administrators develop library policies, manage budgets, hire staff, and handle public relations.

The work of librarians. The work that librarians do depends on what career they choose within the profession. But most librarians pursue one of three tasks: (1) developing collections, (2) organizing materials, or (3) communicating information.

Developing collections may involve starting a new library or improving the materials in an existing one. In either case, a librarian must determine how much information is needed and what types of material the collection should include. These decisions should be made in relation to the purpose of the library, the kinds of people it serves, and the amount of money available. The librarian then decides what books, magazines, videotapes, and other media the library needs and can afford. Librarians must choose wisely from the enormous amount of material in print, electronic, and other information forms.

Some parts of a collection become quickly outdated, and a librarian needs to replace items that are no longer accurate. For example, scientific materials may become out of date in only a few years. Other items—though old—are still important to a library's collection. But these items may decay over time, especially when they are printed on acidic paper. Librarians must watch for decaying materials and find ways to preserve them, such as recording old books on microfilm (see the *Aging books* section of this article).



Odyssey Productions

A librarian's work often requires day-to-day contact with people—listening to them and answering their questions. Many librarians find such personal contact richly rewarding.

Organizing materials, or cataloging, provides library users with easy ways to find information. To do this, the librarian creates a description of each new item in a collection. If the item is a book, the description usually includes the author, title, and place and date of publication. The description also has a list of subjects that the item covers. In addition, a librarian must decide how to classify a book in relation to other materials in a collection. A book on economics, for example, would be classified—and arranged in the library—with other books on economics.

A librarian also assigns a *call number* to the new item. A call number is a combination of numbers and letters that identifies an item. Call numbers should reflect the classification of an item according to its subject matter. The record of all items in a collection make up a library's catalog, which librarians may store on cards or on a computer. Computerized catalogs—also called on-line public access catalogs—enable library users to find items by their subject, author, title, or call number. For more information on how librarians organize materials, see the section *A student guide to better writing, speaking, and research skills* in the Research Guide/Index, Volume 22.

Communicating information ranges from book recommendations to complex research projects. Often, a librarian simply helps a patron find an answer to a specific question, such as "When was Martin Luther King, Jr. born?" For such requests, the librarian turns to readily available reference sources. People frequently ask librarians to find a good book for recreational reading. The person's age, educational level, and background

determines what the librarian will recommend.

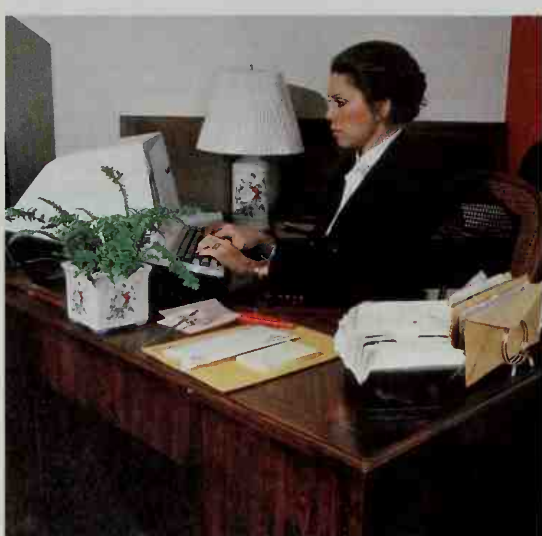
Librarians tailor information services to their patrons' needs. In a law library, the librarian might look up court decisions made by a particular judge. A university librarian might conduct classes on the library's technological resources. Public librarians sometimes provide booklists, film series, and other information for particular cultural groups. For example, a librarian in a Chinese-American community might make a list of materials on Chinese history.

Librarians try to communicate information to people who may not visit the library. Advertising and public relations help librarians inform people how to benefit from libraries. A librarian may also bring library materials to hospitals, community centers, and prisons.

Interests and skills. The library profession attracts people with varying interests and backgrounds because of the wide range of work that librarians do. For example, the profession may appeal to someone who wants to work with children in an elementary school library. A person interested in research may choose to work in a library that scholars use for their investigations. Some people become librarians to help libraries and patrons adapt to advanced technological resources. People who have in-depth knowledge of a foreign language, computers, or a specific subject may choose librarianship to make use of these skills.

Librarians, however, tend to share similar interests. They want to contribute to society and to help people satisfy their information needs. Librarians typically have a strong commitment to public service. Many librarians enjoy keeping up with the latest knowledge.

Educational requirements. A person must have a master's degree from an officially recognized library program to qualify for most professional positions in the United States. In schools of library and information science, students learn how to collect, organize, preserve, and communicate information. Students may specialize in a particular field, such as public libraries or information science. Some schools offer internships, so that students have experience working in libraries.



Data Que (WORLD BOOK photo by Milt and Joan Mann)

A library consultant, such as the one above, helps clients obtain information from libraries. Librarians also serve the general public, students and teachers, and public officials.

The ALA has officially recognized more than 55 graduate library and information science programs in the United States and Canada (see the table with this article). A number of schools offer programs that the ALA does not recognize. Some meet the requirements set by various states for school librarians.

Most students must hold a bachelor's degree for admission into graduate school. In their undergraduate work, future librarians may specialize in almost any subject. However, some schools require undergraduate courses in computers, statistics, or a foreign language. For some library positions, students should take additional courses. Art librarians, for example, need a background in art history.

The need for librarians. During the 1900's, various factors helped bring about a general increase in the need for librarians. For example, the importance of education rose steadily. The extent of knowledge increased, which caused the rapid growth of information in all fields. The population also grew, and more people attended high school or college.

Even so, overall economic conditions have created difficulties for the library profession. In the 1960's, the costs of materials and technology soared. Libraries faced severe budget problems in the 1970's and early 1980's. One result of these financial problems was a temporary lack of library jobs for trained professionals. By the late 1980's, more library positions became available. But there was a shortage of trained librarians. Many librarians had retired, and fewer people were enrolling in library schools.

Librarians today have many opportunities to use their skills. Librarians with computer training can help libraries keep pace with the latest technology. More businesses and organizations are hiring librarians to help them quickly locate information. Librarians increasingly work outside the traditional library setting.

Professional associations. Librarians work together in a number of organizations that promote library services and set standards for the profession. Most associations offer opportunities for continuing education. They may also hold conferences or publish journals to communicate information about the field. The largest and oldest group is the American Library Association (ALA), which was founded in 1876. The Canadian Library Association (CLA) was founded in 1946. See **American Library Association; Canadian Library Association.**

Other library associations serve the specialized interests of their members. These groups include the Special Libraries Association and the Catholic Library Association (see **Special Libraries Association; Catholic Library Association**). Other such associations are the American Association of Law Libraries, the American Society for Information Science, the Association for Library and Information Science Education, the Association of Jewish Libraries, the Association of Research Libraries, the Bibliographical Society of America, the

Accredited library schools

School	Location	School	Location
	In the United States		
Alabama, University of	Tuscaloosa, Ala.	**North Carolina, University of**	Greensboro, N.C.
Arizona, University of	Tucson, Ariz.	**North Carolina Central University**	Durham, N.C.
California, University of	Los Angeles, Calif.	**North Texas, University of**	Denton, Tex.
Catholic University of America	Washington, D.C.	**Oklahoma, University of**	Norman, Okla.
Clarion University of Pennsylvania	Clarion, Pa.	**Pittsburgh, University of**	Pittsburgh, Pa.
Clark Atlanta University	Atlanta, Ga.	**Pratt Institute**	New York, N.Y.
Dominican University	River Forest, Ill.	**Puerto Rico, University of**	Rio Piedras, P. R.
Drexel University	Philadelphia, Pa.	**Rhode Island, University of**	Kingston, R.I.
Emporia State University	Emporia, Kans.	**Rutgers The State University of New Jersey**	New Brunswick, N.J.
Florida State University	Tallahassee, Fla.	**St. John's University**	Jamaica, N.Y.
Hawaii, University of	Honolulu, Hawaii	**San Jose State University**	San Jose, Calif.
Illinois, University of	Urbana-Champaign, Ill.	**Simmons College**	Boston, Mass.
Indiana University	Bloomington, Ind.	**South Carolina, University of**	Columbia, S.C.
Iowa, University of	Iowa City, Iowa	**South Florida, University of**	Tampa, Fla.
Kent State University	Kent, Ohio	**Southern Connecticut State University**	New Haven, Conn.
Kentucky, University of	Lexington, Ky.	**Southern Mississippi, University of**	Hattiesburg, Miss.
Long Island University	Brookville, N.Y.	**Syracuse University**	Syracuse, N.Y.
Louisiana State University	Baton Rouge, La.	**Tennessee, University of**	Knoxville, Tenn.
Maryland, University of	College Park, Md.	**Texas, University of**	Austin, Tex.
Michigan, University of	Ann Arbor, Mich.	**Texas Woman's University**	Denton, Tex.
Missouri, University of	Columbia, Mo.	**Washington, University of**	Seattle, Wash.
New York, City University of (Queens College)	Flushing, N.Y.	**Wayne State University**	Detroit, Mich.
New York, State University of	Albany, N.Y.	**Wisconsin, University of**	Madison, Wis.
New York, State University of	Buffalo, N.Y.	**Wisconsin, University of**	Milwaukee, Wis.
North Carolina, University of	Chapel Hill, N.C.		
	In Canada		
Alberta, University of	Edmonton, Alta.	**Montreal, University of**	Montreal, Que.
British Columbia, University of	Vancouver, B.C.	**Toronto, University of**	Toronto, Ont.
Dalhousie University	Halifax, N.S.	**Western Ontario, University of**	London, Ont.
McGill University	Montreal, Que.		

Source: American Library Association.

Library Public Relations Council, the Medical Library Association, the Music Library Association, and the Theatre Library Association. Many of these groups belong to the Council of National Library and Information Associations.

Other careers in libraries. Libraries often hire staff to support the library's activities. *Circulation clerks* assist library users in borrowing materials, and *acquisitions assistants* place orders for books or other materials. Experts in administration, computers, and public relations may also work in a library. These people meet the educational requirements set by their professions, and many have taken classes in librarianship or information science.

History

The history of libraries parallels the history of writing. For about 5,500 years, people have made written records of their ideas, their relations with others, and the world around them. They have kept their records on a variety of materials—bone, clay, metal, wax, wood, papyrus, silk, leather, parchment, paper, film, plastic, and magnetic tape. At almost every stage in the development of these materials, people have assembled collections of their records into libraries.

Ancient libraries of clay. Libraries of clay tablets were established in ancient Mesopotamia, a region that now covers part of Iraq, Syria, and Turkey. The people of Mesopotamia discovered that they could make lasting records by marking wet clay, which was then dried or baked. Thousands of these clay tablets still exist, but scholars have not yet learned the meaning of the markings on all of them.

The Sumerians, a people who lived in southern Mesopotamia, made some of the oldest clay tablets archaeologists have discovered. The Sumerians wrote on these tablets more than 5,000 years ago. A library of 30,000 clay tablets has been found at the site of the ancient city of Nippur (see **Sumer**). Archaeologists have found other libraries of clay tablets in excavations of ancient cities in Syria and Turkey.

In 1850, British archaeologists discovered thousands



Granger Collection

A clay tablet of the 600's B.C. lists literary works, probably for use in the Royal Library at Nineveh in Babylonia. The Mesopotamians collected thousands of such tablets for huge libraries.

of clay tablets at the site of Nineveh. Nineveh was the capital of ancient Assyria, which occupied northern Mesopotamia. The tablets formed part of a library in the palace of King Sennacherib of Assyria, who ruled from 704 to 681 B.C.

In 1853, a larger library was found nearby. Sennacherib's grandson, Ashurbanipal, had assembled this collection. Ashurbanipal brought together a huge collection of records from earlier kingdoms and empires. See **Assyria** (Language and literature).

Ancient libraries of papyrus. During the period that the peoples of Mesopotamia wrote on clay, the Egyptians used *papyrus,* a writing material made from the papyrus reed. This reed grew in the marshlands of the Nile River. The Egyptians cut its stems into strips, pressed the strips into sheets, and joined the sheets to form scrolls. Some of the scrolls reached great lengths. One, called *Harris Papyrus 1,* is 133 feet (41 meters) long. This scroll is in the British Library.

Papyrus is extremely perishable. Even so, some ancient writings on papyrus have survived. The oldest ones date from about 2700 B.C. *Harris Papyrus 1* dates from the 1100's B.C.

Papyrus became the preferred writing material among peoples of the Mediterranean area about 500 B.C., and it remained so until about A.D. 300. The Egyptians used papyrus until the 900's. See **Papyrus; Manuscript** (Papyrus manuscripts).

The great libraries of ancient Egypt, Greece, and Rome consisted of collections of papyrus scrolls. But these libraries disappeared, and most of what we know about them is based on second-hand reports. For example, scholars have found references to Egyptian libraries at Amarna in the 1300's B.C. and at Thebes in the 1200's B.C. However, these ancient libraries of papyrus have disappeared.

Egypt. The most famous library of ancient times was the Alexandrian Library in Alexandria, Egypt. Alexander the Great founded Alexandria in the 330's B.C. His successors as ruler of Egypt, Ptolemy I and Ptolemy II, developed the Alexandrian Library into the greatest collection of scrolls in the ancient world. The Ptolemies borrowed books from libraries in Athens and other cities and had them copied. According to legend, Ptolemy II shut 72 Jewish scholars in cells on the island of Pharos until they produced the *Septuagint,* the first known Greek translation of the Hebrew Old Testament.

The Alexandrian Library had a copy of every existing scroll known to the library's administrators. The library housed more than 400,000 scrolls. A succession of famous scholars headed this library, which became famous for the scholarly studies it supported as well as for its collection. Not a trace of the Alexandrian Library remains today, and no one knows for certain what became of it.

Greece. The Greeks also used papyrus. Some historians credit Pisistratus, a ruler of Athens during the 500's B.C., with establishing that city's first government-owned library. Most people of ancient times could not read, and so "public" libraries—like that of Pisistratus—served only a small minority of the population.

The philosopher Aristotle founded the most famous library of ancient Greece at his school at the Lyceum. The library served the same purpose as a university library today. The library no longer exists. According to one tradition, Aristotle's successors sold its collection to the Alexandrian Library. Another account says Lucius Cornelius Sulla, a Roman general who looted Athens, took the collection to his palace in Rome.

Rome. The ancient Romans continued the library-founding tradition of the Egyptians and Greeks. The earliest Roman libraries were personal collections. Greek literature, which the Romans admired, formed the main part of these collections. The possession of a personal library became a status symbol in Rome, and writers often mocked the practice.

The Roman soldier-statesman Julius Caesar made plans for a public library in Rome. The Octavian Library probably resulted from his plans. Emperor Augustus built this library on Rome's Palatine Hill in 37 B.C., seven years after Caesar's death. The Octavian Library may have been Rome's first public library. The Romans built many other public libraries soon after. A survey of im-



Detail of a German engraving (1800's) (Granger Collection)

The Alexandrian Library in Alexandria, Egypt, was the most famous library of the ancient world. It had a copy of every existing scroll known to the library's administrators.

portant Rome buildings in A.D. 337 included 28 libraries. The best of these was the Ulpian Library, built about A.D. 110 by Emperor Trajan. It had separate buildings for storing Greek and Latin books.

The Romans encouraged the establishment of libraries throughout their huge empire. Some of the buildings that resulted still stand. They include Hadrian's Library, which was built by Emperor Hadrian at the foot of the Acropolis in Athens about A.D. 125.

The great collections of the papyrus libraries of the Roman Empire disappeared, like those of ancient Egypt and Greece. But one collection, which belonged to a Roman nobleman named Lucius Calpurnius Piso, survived. Piso lived in Herculaneum, a town at the foot of Mount Vesuvius, a volcano. In A.D. 79, Vesuvius erupted, and Herculaneum and the nearby towns of Pompeii and Stabiae were buried.

In the 1750's, excavators uncovered the library. The National Archaeological Museum in Naples has about 1,800 of the papyrus scrolls.

Ancient libraries of animal skin. Scholars of the ancient world wrote on leather—which is made from animal skins—when papyrus was not available. During the 1940's and early 1950's, hundreds of manuscripts, chiefly leather scrolls, were found in caves near the shore of the Dead Sea. These Dead Sea Scrolls, as they are called, probably belonged to the library of a Jewish religious group called the Essenes. The Essenes lived in the highlands near the Dead Sea from about 150 B.C. to A.D. 68. One of the main activities of the group's members was the copying of religious texts. The Dead Sea Scrolls include the oldest known manuscripts of the Bible. See **Dead Sea Scrolls.**

Parchment, made from thin layers of animal skin, enabled scribes and librarians to create books. According to legend, parchment came into wide use because of the rivalry between the library in Alexandria and the library of Pergamum, a city in what is now Turkey. When Pergamum's library threatened to become better than Alexandria's, the Egyptians cut off the supply of papyrus to Pergamum. So the people of Pergamum developed parchment. The word *parchment* comes from *Pergamum.*

Parchment sheets did not easily join into rolls, as did sheets of papyrus or leather. Instead, scribes and librarians began to fold several sheets of parchment down the middle and sew them into books. People soon discovered that books outlasted scrolls. By the A.D. 400's, parchment had largely replaced papyrus in Europe.

Libraries of the Middle Ages and the Renaissance. In A.D. 378, when the Roman Empire was declining, the historian Ammianus Marcellinus complained that "The libraries are closing forever, like tombs." His statement reflected part of a decline in all forms of education that was taking place in Europe.

In 395, the Roman Empire split into two parts—the West Roman Empire, which had its capital in Rome, and the East Roman Empire, which had its capital in Constantinople (now Istanbul, Turkey). By the late 400's, the West Roman Empire had ended and the period known as the Middle Ages began. This period lasted until the 1500's. During the first half of the Middle Ages—until about the late 900's—educational and artistic activity sank to a low level in Europe. Such activity took place in relatively few places in the Western world.

Medieval collections. Chief among the places where education continued to flourish was Constantinople, the capital of the Byzantine, or East Roman, Empire. The learning and cultural activity that continued there provided a link between ancient and modern European civilizations.

During the 500's in Constantinople, for example, a group of legal scholars used library materials and other resources to produce the Justinian Code. This collection of Roman laws ranks among the most important legal documents of all time. It became the foundation for the legal systems of many countries today. During the 900's, the encyclopedic work known as *Suidas* recorded knowledge on Greek literature that would otherwise have been lost. The crusaders destroyed much of Constantinople in 1204, and its libraries disappeared completely after the Ottoman Empire took over the city in 1453.

Christian monasteries also made a major contribution to the preservation of libraries and learning during the early Middle Ages. The copying of manuscripts became a major activity of the monks who lived in monasteries throughout Europe and in parts of Asia and Africa. The monks worked in a room called a *scriptorium.* Most of the manuscripts they copied were from religious works, especially the Bible. But they also copied other works, including writings from ancient Greece and Rome. The monks sold some of the copies they made and kept others in the monastery libraries.

A scholar found one of the oldest copies of the Bible in 1844 in Saint Catherine's monastery, on the Sinai Peninsula at the western tip of Asia. This manuscript, called *Codex Sinaiticus,* dates from the early 300's and is now in the British Library. Other important texts were found in the libraries of Greek monasteries on Mount Athos and of Coptic monasteries in Egypt. In Bethlehem, from 386 to 420, Saint Jerome produced a large body of sacred writings. These works included his famous Latin

translation of the Bible, called the *Vulgate,* which is still in use.

About 540, Cassiodorus, a Roman nobleman, established a monastery on his estate in southern Italy. The monks there made both religious and nonreligious books. Cassiodorus has been called the *father of literary monasticism in the West.* Many other monasteries also gained importance for their scriptoriums and libraries. Ireland contributed much to the movement. Irish monks produced many books, and the monks also founded monasteries in other parts of Europe.

The modern university began to develop in Europe during the 1100's. Instruction and discussion, rather than research, were the main features of the earliest universities. But research gained importance through the years, and the universities gradually developed great library resources.

Renaissance collections. The growth of the universities reflected Europe's emergence from the Middle Ages and entry into the Renaissance, a revival of art and learning that began in Italy about 1300. Europeans acquired a great desire for artistic and literary works and looked back to ancient Greece and Rome for inspiration. Scholars found and translated ancient writings, and writers created literatures of their own.

The renewed interest in learning led many aristocrats to develop private libraries. Cosimo de' Medici began one such private collection in Florence, Italy, during the 1400's. It formed the basis of the Laurentian Library, which ranks among the world's finest libraries today. The famous artist Michelangelo designed its building. In England, Humphrey, Duke of Gloucester, accumulated a large and valuable collection of writings. He gave the collection to Oxford University in the early 1400's, and the university's library still has some of the writings. The Vatican Library also dates from the 1400's. This library of the Roman Catholic Church houses some of the world's most valuable literary treasures.



Detail of a French manuscript (1300's); Bibliotheque Nationale, Paris (Granger Collection)

A monk in a scriptorium copies a manuscript by hand. Such laborious work by medieval Christian monks helped preserve writings of ancient times for libraries of today.

Paper, printing, and libraries. Paper is better suited for the manufacture of books than is any other material. The Chinese invented paper by A.D. 1, though they did not use it for writing until about A.D. 110. The art of papermaking reached Baghdad (now in Iraq) by 800, Egypt by 900, and Europe by 1100. The use of paper grew rapidly in Europe, and paper had almost completely replaced parchment by 1500.

During the Renaissance in Europe, the spread of education and the increasing desire for knowledge created a demand for books. Scribes, however, could not meet this demand by hand copying. The problem was solved by the invention of printing from movable type. The Asians had known of movable type for centuries, but the idea was lost until Europeans rediscovered it in the 1400's. Johannes Gutenberg of Germany is credited with the rediscovery. Gutenberg began printing books in the mid-1400's, and his technique spread rapidly. See **Gutenberg, Johannes.**

Printing on paper revolutionized bookmaking. More books could be printed, and more people could afford to buy them. The printed book also brought many changes in libraries. Books gradually replaced handwritten manuscripts. The books were put on open shelves, not in chests, as the manuscripts had been. By 1600, libraries had started to look like present-day libraries. Shelves of books lined the walls, and tables for readers stood in the middle of the room.

Libraries of the 1600's and 1700's. A golden age for libraries took place in the 1600's and 1700's. Many great libraries that still exist opened in Europe, a number of them in universities. The first state-supported libraries were also founded.

Britain. Duke Humphrey's library at Oxford was almost completely destroyed in the mid-1500's, when the government sought to wipe out all traces of Roman Catholicism. Sir Thomas Bodley, an English statesman, began to rebuild the library in the late 1500's. It was renamed the Bodleian Library. This library grew through the years, and today it ranks as Britain's second largest (see **Bodleian Library**). In 1759, Britain opened the British Museum, which included a museum and a national library. The library, which became the British Library in 1973, is the nation's largest and contains many priceless treasures. See **British Library.**

The public library tradition in Britain has been strong since the late 1800's. But traces of it date back hundreds of years. The first known public library in Britain began in the Guildhall in London in 1425. The second began in Edinburgh, Scotland, in 1580. These libraries no longer exist. The first continuing library that was open to the public was founded in Manchester, England, in 1653. Parliament passed the Public Libraries Act in 1850, and public libraries gradually spread throughout Britain.

France. The national library of France, the Bibliothèque Nationale in Paris, began in 1367 as the Royal Library of King Charles V. During the French Revolution (1789-1799), the Royal Library became the Biblio-

thèque Nationale de France. The Bibliothèque ranks among the largest and most important libraries in the world. See **Bibliothèque Nationale de France.**

In 1643, Jules Cardinal Mazarin founded the great Mazarine Library in Paris. He collected books and manuscripts from all parts of Europe and opened the library to the public. The library is famous for its influence on the methods of operating libraries. Cardinal Mazarin's librarian, Gabriel Naudé, wrote one of the first explanations of library management. Librarians consider much of what Naudé wrote as valid today. The French government now owns the Mazarine Library.

Italy. The great libraries of Italy include the Laurentian Library in Florence, the Vatican Library in Vatican City, the Ambrosian Library in Milan, and the National Central Library in Florence. The Laurentian and Vatican libraries are described in the *Medieval collections* section of this article. The Ambrosian Library, founded in 1609, is noted for its collections of manuscripts by Asians, monks, and scientists. The National Central Library is based on the collection of Antonio Magliabechi, a scholar of the 1600's and 1700's.

Germany. In Germany, three libraries perform the functions of a national library—the German State Library in Berlin, the German Library in Leipzig, and the German Library in Frankfurt. The German State Library was founded in 1661 by Frederick William, ruler of the state of Brandenburg. The library became, in turn, the Royal Library, the Prussian State Library, and the German State Library. The German Library in Leipzig was founded in 1912. The one in Frankfurt was founded in 1946.

Russia. The M. E. Saltykov-Shchedrin State Public Library in St. Petersburg, one of Russia's chief libraries, was founded in the late 1700's by Empress Catherine the Great. The largest Russian library, the Russian State Library in Moscow (formerly the Lenin State Library), dates from 1862.

Other European libraries. The Royal Library of Denmark in Copenhagen was established in 1657. King Philip V founded the National Library of Spain in Madrid in 1711. In Portugal, the National Library in Lisbon dates from 1796. National libraries, as well as great university libraries, were founded in many other European countries during the 1600's and the 1700's.

Libraries in the East. The Chinese developed a deep respect for scholars and scholarship in ancient times. Ancient Chinese libraries were established for use by scholars, royalty, and aristocrats. The libraries helped advance and preserve Chinese learning. This learning became a major influence in China and in other Asian countries. The East did not experience a decline in learning during the Middle Ages, as did the West. But libraries and other educational tools were used only by scholars and the upper class until the 1900's.

Libraries in Latin America. Spanish *conquistadors* (conquerors), priests, and colonists brought the first large collections of books to Latin America during the 1500's and 1600's. Latin America's oldest libraries are university libraries. The University of Santo Domingo in the Dominican Republic was founded in 1538. It is the oldest university in the Western Hemisphere. The National Autonomous University of Mexico in Mexico City and the University of San Marcos in Lima, Peru, were established in 1551. The libraries of these universities probably date from the time the schools were founded.

Latin America established its largest national libraries in the 1800's. Argentina's national library in Buenos Aires and Brazil's national library in Rio de Janeiro opened in 1810. The national library of Chile was established in Santiago in 1813. Mexico's national library dates from 1833.

Libraries in the United States. The oldest library in the United States dates from 1638, when Massachusetts clergyman John Harvard donated money and about 400 books to a new university. The gift was so important that administrators promptly named the university for Harvard, and the library became the Harvard University Library.

Colonial libraries. Most early colonial libraries belonged to ministers and consisted of useful books on religion, medicine, and animals. Thomas Bray, an English clergyman, established the first free lending libraries in the American Colonies during the late 1600's. However, interest in these libraries disappeared after Bray's death in 1730.

In the 1700's, the colonists attempted to make books available to many people with the establishment of *subscription libraries.* People paid dues to become members of subscription libraries, and dues were used to buy books. The members could then borrow the books free of charge. In 1731, Benjamin Franklin and his friends founded the first subscription library in America, the Library Company of Philadelphia. The company's original collection still exists (see the *Libraries and museums* section of the **Philadelphia** article). The success of the company caused many other subscription libraries to open. *Circulating libraries,* in which owners operated the libraries for a profit, also came into use.

Several colonial leaders developed personal libraries. Notable collections included those of William Brewster, William Byrd, Cotton and Increase Mather, and John Winthrop.

Libraries in the new nation. Like their colonial predecessors, many leaders of the new United States had vast personal libraries. One of the most extensive was that of Thomas Jefferson. In 1815, Congress bought Jefferson's collection for the Library of Congress, which had burned during the War of 1812. The library was rebuilt around Jefferson's books.

Several changes in U.S. life during the 1800's increased the popularity of libraries. Immigrants flocked to the United States. Many people moved to cities to find work in factories, and others settled in the West. All of these people turned to libraries for education and entertainment, and circulating and subscription libraries flourished. Other kinds of libraries developed, such as church libraries and women's club libraries.

The U.S. ideal of a free public education for every child led naturally to a movement for free public libraries. One of the nation's first free tax-supported libraries was established in Peterborough, New Hampshire, in 1833. The idea spread rapidly. In 1846, the Smithsonian Institution—a center devoted to research and learning—was founded in Washington, D.C. Some of its early proj-

ects reflected the keen interest in libraries sweeping the country. For example, the Smithsonian took a census of the nation's libraries. It attempted to develop a national union catalog and a procedure for printing catalogs. The institution organized the first convention of librarians in 1853. Charles Coffin Jewett, the Smithsonian's first librarian, directed all of these activities.

Other significant developments in libraries took place during the 1800's. The National Library of Medicine opened in 1836, and the National Library of Agriculture opened in 1862. William Frederick Poole, a librarian, helped write an index to publications called *Poole's Index to Periodical Literature* (1882). The index listed published articles between 1802 and 1881, and ranks as a classic among reference books. Supplements carried the index through 1906. A later work, *Readers' Guide to Periodical Literature,* updates the index to present day.

Melvil Dewey became one of the major figures in the history of American libraries. Dewey had a part in three major library events that took place in 1876. He helped found the American Library Association that year. He also helped start the *Library Journal,* a magazine of library news and trends and of book reviews. In addition, Dewey published the Dewey Decimal Classification in 1876. Dewey also established the nation's first library school, at Columbia University in 1887. Other librarians who made important contributions to library development include Caroline M. Hewins, a pioneer in children's library work, and Katharine L. Sharp, founder of the first Midwestern library school in 1893.

In 1881, Andrew Carnegie gave the first of a series of gifts that made his name almost synonymous with public libraries. Carnegie had earned a huge fortune in the steel industry. He helped build more than 2,500 public libraries in the English-speaking world between 1881 and his death in 1919. About 1,700 of these libraries were built in the United States. See **Carnegie, Andrew.**

The development of modern library systems. Since 1900, the United States has made great progress in the development of libraries and library services. The number of public libraries has multiplied greatly, and more branches and bookmobile services have enabled libraries to serve more people. In 1900, only the Library of Congress had more than 1 million items. But by the 1980's, about 150 U.S. libraries had collections of more than 1 million items. The 1900's also brought a rise in the quantity and quality of school and special libraries.

Today, the federal government helps support libraries. It provides national library services for the blind and the disabled. The government makes grants to the states for library service and construction. It provides assistance to libraries in higher education and to medical libraries.

In 1970, the government established the National Commission on Libraries and Information Science. This commission advises the president and Congress on library and information policy, studies library programs, and develops plans for coordinating library and other information programs in the United States.

Libraries in Canada. Library development in Canada has largely paralleled that of the United States. Canada's first college library was established in 1635 at the Jesuit College of Quebec. The Canadian Library Association was founded in 1946. In 1953, Canada established a national library in Ottawa. See **Canada (Education)** and the section on *Libraries* in each province article.

Mohammed M. Aman, Toni Carbo, Dan O. Clemmer, Kenneth E. Dowlin, Michael E. D. Koenig, Constance W. Nyhan, Joanne E. Passet, Gary E. Strong, Kay E. Vandergrift, and Duane E. Webster

Study aids

Related articles in *World Book.* See the section on *Libraries* in the articles on states, provinces, countries, and large cities. See also the following articles.

Biographies

Dewey, Melvil
MacLeish, Archibald

Famous libraries

Bibliothèque Nationale de France
Bodleian Library
British Library
Folger Shakespeare Library
Library of Congress
Pierpont Morgan Library

Library associations

American Library Association
Canadian Library Association
Catholic Library Association
Special Libraries Association

Other related articles

Book
Book collecting
Bookbinding
Bookmobile
Caldecott Medal
Carnegie Corporation of New York
Censorship
Communication
Copying machine
Copyright
Dewey Decimal Classification
Information retrieval
Information science
Information theory
International standard book number
Library of Congress classification
Literature
Literature for children
Manuscript
Microfilm
Newbery Medal
Obscenity and pornography
Presidential libraries
Printing
Publishing
Reading
Regina Medal

Outline

I. **The library today**
   A. Contents and kinds of libraries
   B. Library services
   C. Other features
   D. Challenges and problems
II. **Public libraries**
   A. Kinds of public libraries
   B. Services for children
   C. Services for young adults
   D. Services for adults
   E. Services for special groups
   F. Spreading the service
   G. Administering a public library
   H. Supporting the public library
III. **School libraries**
   A. Elementary school libraries
   B. Middle school and junior high school libraries
   C. High school libraries
   D. School library standards
IV. **College, university, and research libraries**
   A. College and university libraries
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V. **Government libraries**
   A. United States government libraries
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VI. **Special libraries**
VII. **Information science and technology**
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   A. Western Europe
   B. Eastern Europe and Russia
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   E. South and Southeast Asia
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   H. International library programs
IX. **Careers in library work**
   A. Careers for librarians
   B. The work of librarians
   C. Interests and skills
   D. Educational requirements
   E. The need for librarians
   F. Professional associations
   G. Other careers in libraries
X. **History**

Questions

What are some of the differences between past and present libraries?
What challenges and problems do libraries face?
Discuss the role of technology in today's libraries.
What services does a state library provide to the state government? To other libraries?
What role does the United States government play in the development of local public libraries?
Discuss and compare library development around the world.
What did Melvil Dewey and Andrew Carnegie contribute to the development of libraries?
What are some careers available in the library profession?
How do school librarians serve their communities?
What kinds of media might a typical public library provide?

Additional resources

Level I
Cummins, Julie. *The Inside-Outside Book of Libraries.* Dutton, 1996.
Lerner, Fred. *Libraries Through the Ages.* Continuum, 1999.
Malam, John. *Library.* Bedrick, 2000.

Level II
Bloch, R. Howard, and Hesse, Carla, eds. *Future Libraries.* Univ. of Calif. Pr., 1995.
Gates, Jean K. *Guide to the Use of Libraries and Information Sources.* 7th ed. McGraw, 1994.
Lerner, Fred. *The Story of Libraries.* 1998. Reprint. Continuum, 2001.
Wiegand, Wayne A., and Davis, D. G., Jr., eds. *Encyclopedia of Library History.* Garland, 1994.

Library of Congress, located just east of the United States Capitol, is one of the largest and most valuable research libraries in the world. The library has about 120 million items in its collections, including over 25 million books, pamphlets, and other printed materials. There are over 35 million items in the special collections, including charts, engravings, maps, motion pictures, photographs, and recordings.

The library owns about 5,700 *incunabula* (books printed before 1501), the largest collection in the Western Hemisphere. They represent the earliest products of the printing press, which was invented about 1450. This collection includes a perfect copy of the Gutenberg Bible, the first important book printed in the Western world.

The library's 54-million-piece manuscript collection represents all aspects of American life and culture. The U.S. history collection contains the papers of almost every president from George Washington to Calvin Coolidge. The library's collections of Chinese, Japanese, and Russian materials are the largest in the world outside eastern Asia and Russia.

The library's first responsibility is to provide research and reference assistance to the U.S. Congress. However, it also serves as the national library, having extended its services over the years to government agencies, other libraries, scholars, and the general public. The librarian of Congress administers the library. The librarian is appointed by the president of the United States and must have the approval of the Senate.

The Library of Congress provides cataloging information to other libraries on printed cards, on magnetic

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The Main Reading Room of the Library of Congress, *shown here,* is the center of the greatest research library in the United States. Scholars from all parts of the world come to study at the library.

tapes, and in book catalogs. Through a program called *Cataloging in Publication,* the library gives publishers cataloging data to be printed directly in books, usually on the back of the title page. The Library of Congress loans other libraries books that are unobtainable elsewhere and supplies photocopies of other materials. The library also provides books in braille and recorded books to blind and disabled readers. More than 160 cooperating libraries help distribute these materials.

One department of the library administers the copyright laws. Two copies of every publication for which an author requests copyright protection must be deposited in the library. The library selects items for its collections from these deposits. A division of the library called the Center for the Book in the Library of Congress attempts to stimulate public interest in books and reading and to encourage the study of the printed word. It sponsors various activities, including lectures, exhibitions, and reading promotion projects.

Congress established the library in 1800. It appropriated $5,000 to buy books and furnish a room in the Capitol for the library. This first library was destroyed in 1814 when the British burned the Capitol.

Congress immediately began building up a new library in the Capitol. In 1815, it purchased the private library of Thomas Jefferson, which had about 6,000 books. The Library of Congress continued to grow, although several fires—the most serious in 1851—damaged the collections. In 1897, the library moved to a new gray sandstone building east of the Capitol because it was too large to be kept in the Capitol. In 1938, an annex of white Georgia marble was built on an adjoining site. In 1980, the James Madison Memorial Building, the largest library building in the world, was constructed. At this time, the 1897 structure was renamed the Thomas Jefferson Building and the 1938 annex was renamed the John Adams Building. Together, the three library buildings have about 71 acres (29 hectares) of floor space.

Critically reviewed by the Library of Congress

See also **Library; Library of Congress Classification; Hayes, Rutherford B.** (Congressman); **Putnam, Herbert.**

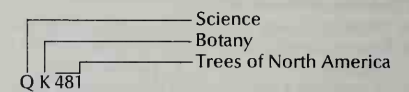
Additional resources

Conaway, James. *America's Library: The Story of the Library of Congress, 1800-2000.* Yale, 2000.
Fowler, Allan. *The Library of Congress.* Children's Pr., 1996. Younger readers.
Highsmith, Carol M., and Landphair, Ted. *The Library of Congress.* Fulcrum, 1994.

Library of Congress Classification is a system for arranging materials in a library. Many large research and university libraries use this system. It provides greater precision in most fields and more room for expansion than the Dewey Decimal Classification (see **Dewey Decimal Classification**).

Each Library of Congress classification is represented by a set of capital letters and numbers. The first letter in the set indicates one of 21 major areas of knowledge. These areas include: A-general works; B-philosophy, psychology, religion; C to F-history; G-geography, anthropology, recreation; H-social sciences; J-political science; K-law; L-education; M-music and books on music; N-fine arts; P-language and literature; Q-science; R-medicine; S-agriculture; T-technology; U-military science; V-naval science; and Z-bibliography, library science, information resources. The second letter stands for a subclassification. The numbers represent a specific topic.

In the following example, the book *Familiar Trees of America,* by William C. Grimm, has the number QK 481. The Q stands for science, the K for botany, and the 481 for trees of North America.



The Library of Congress developed its classification system in the early 1900's for its large collection of books. Specialists add or modify about 6,000 classification numbers yearly to account for current events and new knowledge. Critically reviewed by the Library of Congress

Library of Parliament. See **Library** (Canadian government libraries).

Libretto. See **Opera** (The libretto).

Libreville (pop. 350,000) is the capital and largest city of Gabon. Libreville lies in western Gabon on the Gulf of Guinea, an arm of the Atlantic Ocean, and is a major port. For location, see **Gabon** (map).

The city is Gabon's center of commerce and culture. Factories in Libreville manufacture food products, furniture, lumber, and textiles. The city has a variety of educational and research institutions.

Libreville—the name means *free town*—was founded by French naval officers in 1849 as a refuge for freed slaves. In 1883, it became the capital of Gabon, a French colony at that time. It remained the capital after Gabon became independent in 1960. Since the mid-1970's, a convention center and many other buildings have been erected, and urban renewal has modernized the city.

Samuel Decalo

Libya is an Arab country in northern Africa. It lies on the coast of the Mediterranean Sea. The country is bordered by Egypt and Sudan on the east, Chad and Niger on the south, and Algeria and Tunisia on the west. Tripoli is Libya's capital and largest city.

The vast, dry Sahara covers most of Libya, and the country has few natural resources. But the discovery of petroleum in 1959 injected huge sums of money into Libya's economy. The government of Libya used some of this wealth to improve farmland and provide services for the people.

Almost all of Libya's people are of mixed Arab and Berber ancestry and are Muslims. Until the early 1900's, Libya consisted of three separate geographical and historical regions. It became a united, independent country in 1951. Libya's official name is the Great Socialist People's Libyan Arab Jamahiriya.

Government

Muammar Muhammad al-Qadhafi is Libya's head of state, but he holds no official title. In 1969, Qadhafi led a military revolt that overthrew the ruling monarchy.

Libya's government is based on popular assemblies. All Libyan citizens age 18 or older may vote and hold public office. About 1,000 local groups elect a representative to the General People's Congress (GPC), which officially runs the national government. The General People's Congress meets every year to consider legislation and to select the members of the General People's Com-



© J. Paul Kennedy, The Stock Market

Tripoli, Libya's capital and largest city, lies along the Mediterranean Sea. Modern high-rise buildings are common in the city's downtown area. Most Libyans live in urban areas.

mittee, which develops national policy.

Libya is divided into 24 political units called *baldiyas.* A local People's Congress administers each baldiya. Political parties have not been permitted since 1952. In 1971, the Arab Socialist Union was formed as Libya's only political alliance. But a number of underground opposition groups exist.

People

Population and ancestry. About 80 percent of Libya's people live along the Mediterranean coast or in the upland regions just south of the coast. More than 90 percent of Libya's population is of mixed Arab and Berber ancestry. The Berbers lived in Libya before the Arabs arrived in the A.D. 600's.

Languages. Arabic, the official language, is spoken by almost all Libyans. Many educated Libyans speak a second language, particularly English or Italian.

Way of life. Most of Libya's people live in urban areas. The country's rural dwellers live mostly in villages or desert oases. Some nomads move with their sheep, goats, and camels in search of pasture.

The expansion of the Libyan economy after the mid-1900's triggered a substantial migration from rural areas to the cities. The transition from rural to urban life required many difficult adjustments. For example, rural Libyans live as an extended family, with several generations sharing a single home. But this arrangement is not practical in Libya's crowded cities.

The status of women in Libya changed dramatically in the late 1900's. Women once received little or no education and were largely confined to the home. As a result of the changes, women have the legal right to participate fully in Libyan society. But many traditional attitudes about women remain. Libyan women form only about 10 percent of the work force, but this percentage is increasing as more women become educated.

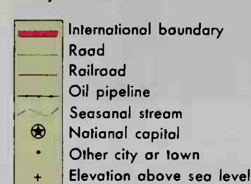
Housing. Libya's large cities look much like those in North America and Western Europe. High-rise office and apartment buildings fill the downtown areas. Suburban areas have more spacious single-family dwellings. In rural areas, most people live in stone or mud-brick houses. Often, families have a single room for all activities and a nearby shelter for their animals. The flood of people from the country to the cities has created overcrowding, particularly in older urban neighborhoods.

Clothing. Traditional garments are commonly worn in rural areas of Libya. Men wear a loose cotton shirt and trousers covered by an outer cloak. They often wear

Facts in brief

Capital: Tripoli.
Official language: Arabic.
Area: 679,362 mi² (1,759,540 km²). *Greatest distances*—north-south, 930 mi (1,497 km); east-west, 1,050 mi (1,690 km). *Coastline*—1,047 mi (1,685 km).
Population: *Estimated 2002 population*—5,869,000; density, 9 per mi² (3 per km²); distribution, 86 percent urban, 14 percent rural. *1994 census*—4,404,986.
Chief products: *Agriculture*—barley, livestock, olives, tomatoes, wheat. *Manufacturing*—cement, petroleum products, processed foods. *Mining*—iron ore, natural gas, petroleum.
National anthem: "Allahu Akbar Fawqa Kayd Al-Motadi" ("God Is Greater Than the Aggressor's Malice").
Flag: The flag of Libya is entirely green. Green is the traditional color of Islam, the religion of most Libyans. Adopted in 1977. See Flag (picture: Flags of Africa).
Money: *Basic unit*—dinar. One thousand dirhams equal one dinar.

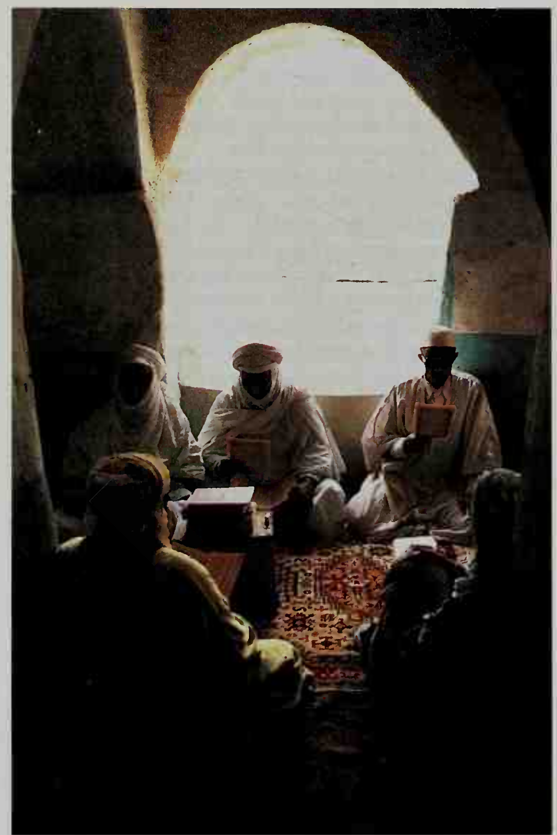
Libya







WORLD BOOK maps



© O. Martel, Photo Researchers

Muslims read the Quran, the holy book of Islam, as shown here. Islam is Libya's official religion. Almost all Libyans are Muslims and belong to the Sunni branch of the religion.

a flat, brimless, tight-fitting cap. Women traditionally wear a full-length robe. Some people in Libya's cities wear these garments to indicate their regard for traditional values and practices. But most city dwellers wear Western-style clothing.

Religion. Islam is Libya's official religion. Almost all Libyans are Muslims and belong to the Sunni branch of Islam. The 1977 constitutions ordered that all legislation must agree with Islamic law.

Education. When Libya became independent in 1951, only about 20 percent of the population could read and write. But oil revenues provided the country with money to attack widespread illiteracy. Today, well over half of Libya's adults can read and write. For Libya's literacy rate, see **Literacy** (table: Literacy rates for selected countries).

All Libyan children from 6 to 15 years of age are required to attend school. The free state education system provides six years of primary school and three years each of preparatory school and high school. Libya has five universities. The largest is Al-Fatah University in Tripoli.

Land and climate

The huge Sahara, the desert that extends across northern Africa, covers about 95 percent of Libya. Except for scattered desert oases, only the land near the Mediterranean Sea in northern Libya is inhabitable and useful for agriculture.

Huge sand dunes make up most of the inland desert region of Libya. A part of the Sahara called the Libyan Desert covers the eastern part of the country's inland area. The desert terrain rises gradually from north to south, forming rugged mountains along the southern border. Libya's highest point, Bette Peak, rises 7,500 feet (2,286 meters) above sea level in the southeast.

The desert climate is characterized by extreme high and low temperatures. Daytime temperatures reach an average high of 100 °F (38 °C). But nights are cool, averaging 50 °F (10 °C). Rainfall in the desert averages less than 2 inches (5 centimeters) each year.

Most Libyans live near the Mediterranean coast. In the west, some live on a fertile plain almost 200 miles (320 kilometers) long. Others live on the coast between Benghazi and Derna. The Green Mountain region east of Benghazi also has many villages. In the center of the country, the Sahara reaches northward to the Gulf of Sidra. It forms a desolate barrier between the densely populated eastern and western stretches of coastline.

The Mediterranean Sea strongly influences the climate of the coastal region. The area has warm summers and mild winters. In January, temperatures in Tripoli average 52 °F (11 °C). July temperatures in Tripoli average 81 °F (27 °C). The coast receives more rain than the inland desert—about 16 inches (41 centimeters) annually.

Economy

Libya has a developing economy that depends heavily on petroleum. But the oil industry employs only a small percentage of the country's workers. Most Libyan workers are employed by service industries and agriculture. Except for agriculture, the government controls most economic activities in Libya.

Mining. Petroleum accounts for about 25 percent of the value of Libya's total economic production, and for almost all the country's export earnings. The national government controls petroleum mining. Libya also has small amounts of gypsum, iron ore, lime, natural gas, and sulfur.

Service industries are economic activities that produce services rather than goods. Such industries make up more than 40 percent of the value of the total economic production in Libya. Government services make up the most important service industry. Other service industries include finance, and wholesale and retail trade.

Construction. The rapid development of the Libyan petroleum industry created the need for many factories, buildings, and other structures. Today, construction accounts for about 12 percent of the value of the country's total economic production.

Manufacturing makes up about 8 percent of the value of Libya's total economic production. The most important manufactured goods are refined petroleum products and petrochemicals. Other products include cement, processed foods, and steel. Libya's northern cities are the chief manufacturing centers.

Agriculture accounts for about 7 percent of the total value of economic production in Libya, but about 18 percent of Libya's people are farmers. Only about 5 percent of the land is agriculturally useful, and Libya must import most of the food it needs. The country's chief

crops include tomatoes, wheat, olives, potatoes, dates, citrus fruits, and barley. Farmers and herders also raise such livestock as cattle, sheep, and chickens.

Families own most of the farmland in Libya. Farms average about 27 acres (11 hectares) in size. Mechanized farm machinery is used on large farms, but traditional tools are often used on small family farms.

Trade. The export of oil and petroleum products accounts for almost the total value of Libyan exports. Food, machinery, textiles, and transportation equipment are major imports. The value of Libya's exports is higher than that of its imports. Germany, Italy, and the United Kingdom are Libya's main sources of imports. Chief markets for exports include Germany, Italy, and Spain.

Transportation and communication. Libya's national airline, Libyan Arab Airlines, connects Libya with other countries. The chief seaports are Tripoli, Benghazi, Misratah, and Port Brega. Libya has no railroads, but paved roads link the major cities of northern Libya and connect them with the desert oases.

Newspapers and periodicals are under strict government supervision. The government's Jamahiriya News Agency publishes Libya's only daily newspaper—*al-Fajr al-Jadid (The New Dawn).* Radio and television broadcasting in Libya are also controlled by the government.

History

Early days. Berbers are believed to be the earliest inhabitants of Libya. In the 600's B.C., Greek colonists settled in the northeastern part of the region. Their province became known as Cyrenaica. In the 400's B.C., the ancient city of Carthage, in what is now Tunisia, established trading centers in the northwestern part of the region. This province became known as Tripolitania.

The Romans destroyed Carthage in 146 B.C., and Tripolitania became part of the Roman province of Africa Nova. A Germanic tribe called the Vandals captured the region in A.D. 431. In the 500's, Byzantine forces conquered the region. Rebellions by Berber tribes created instability that aided Arab entry into the region.

Arab soldiers, spreading their new religion of Islam, entered Cyrenaica in 642 and occupied Tripoli in 643. A succession of Arab and Berber dynasties then controlled what is now Libya. The culture of northwestern Libya developed along with the political units just west of it, while development in the east was strongly influenced by neighboring Egypt.

In 1551, the Ottomans captured Tripoli. They incorporated Tripolitania, Cyrenaica, and the southwestern region known as the Fezzan into their empire, which was centered in Asia Minor (now Turkey). But local rulers had almost complete freedom. From the 1500's to the early 1800's, private ships commanded by Barbary *corsairs* (sea raiders) preyed on European and U.S. shipping in the Mediterranean. The United States fought a war against the corsairs in the early 1800's.

Italian control. Italy invaded the coastal regions in 1911 and took control of the three provinces in 1912. During the 1920's and 1930's, the Italians sponsored many improvement projects, such as towns, roads, and irrigation systems, luring thousands of European immigrants to the country. But in Cyrenaica, the Sanusi brotherhood, a Muslim religious and social reform group, organized stiff opposition to Italian rule. During World War II, members of the Sanusi brotherhood cooperated with the British in Egypt against Italy, their common enemy. In 1942, Britain established a military administration in the north. French forces took control of the Fezzan.



© Erik Bonnier, Gamma/Liaison

The vast Sahara covers most of Libya and makes most of the country uninhabitable and unsuitable for agriculture. The desert has huge sand dunes broken by scattered oases, such as this one.



© G. Chauvel, Sygma

Petroleum mining is one of the leading economic activities in Libya. The country's oil fields are located in the Sahara.

Independence. In December 1951, the United Nations (UN) called for the independence of all of Libya. A federal state came into being, with Muhammad Idris al Mahdi as-Sanusi, leader of the Sanusi resistance, as king. The three provinces—Cyrenaica, Tripolitania, and the Fezzan—had considerable authority to rule themselves. But their separate geographical and cultural development fostered an atmosphere of localism and rivalry that complicated the nation-building process. The provinces were abolished in 1963, and Libya became a united kingdom controlled largely by the central government.

The discovery of oil in Libya in 1959 transformed the country from a poverty-stricken nation into one of the wealthiest in the world. But widespread discontent resulted, because the ruling class controlled the wealth.

In September 1969, a group of officers known as the Revolutionary Command Council (RCC) overthrew King Idris and seized power. Colonel Muammar Muhammad al-Qadhafi, who led the revolution, became the head of Libya's government. Under his rule, the government took control of most economic activities. Qadhafi tried to forge unions with a number of Arab states. But none of these efforts succeeded for more than a brief period.

During the 1970's, oil revenues were used to fund ambitious social and economic development projects. Existing political institutions were replaced by popular assemblies. Despite the appearance of democracy, Qadhafi's government tolerated no political opposition.

Libya supported a number of political movements throughout the world, particularly the Palestine Liberation Organization (PLO) and the Polisario Front, in Western Sahara. It backed a rebellion in Chad. Libya also supported Iran's declaration of an Islamic republic in 1979.

Strained relations with the United States. The leaders of many nations have denounced Qadhafi for interfering in the affairs of other countries. During the 1980's, bitter antagonism surfaced between Libya and the United States. The United States accused Qadhafi of aiding terrorists. Libya, in turn, charged that the United States was attempting to overthrow its government.

In January 1986, U.S. President Ronald Reagan broke all economic ties with Libya. That March, Libya fired missiles on U.S. military aircraft over the Gulf of Sidra. In April, Reagan ordered U.S. planes to bomb military installations at Tripoli and Benghazi. Reagan claimed to have evidence that linked Libya to the bombing of a West Berlin nightclub, in which an American serviceman was killed and many were injured. Conflict again erupted in early 1989, when two American aircraft downed two Libyan jets over the Mediterranean. The American airmen claimed that the Libyan planes were armed and aggressively heading toward them.

During the 1980's, increased production and decreased consumption of petroleum throughout the world caused Libya's oil revenues to decline. Nevertheless, the government moved forward with certain development projects, including a pipeline for carrying water from underground springs in the Sahara to the more densely populated coastal regions.

Recent developments. In April 1992 and December 1993, the United Nations imposed sanctions on Libya for refusing to turn over Libyans suspected of placing bombs on an American civilian airliner that exploded over Scotland in 1988 and a French civilian airliner that blew up over West Africa in 1989. The two explosions killed 441 people. Sanctions included the cancellation of international air service to Libya and the suspension of military sales. In 1999, Libya turned over to UN officials two men suspected of planting the bomb on the American airliner. The UN then suspended its sanctions on Libya. In January 2001, a special Scottish court set up in the Netherlands convicted one of the men of murder and acquitted the other man. Kenneth J. Perkins

See also **Barbary States; Benghazi; Berbers; Qadhafi, Muammar Muhammad al-; Tripoli.**

Lice. See **Louse.**

License means *permission.* The word *license* is most often used to mean a permit granted by a public authority. Sometimes the granting authority is the federal government. Sometimes it is a state or city government.

A license may permit a person to carry on a business or to practice a profession. It implies that the person who receives the license can do the work without injuring the public. For example, a physician must receive a state license in order to practice medicine legally. The license means the state considers the physician qualified.

There are many other kinds of licenses. A person needs a license to legally hunt or fish. In many states and cities, owners must buy a license for their dogs.

Usually a person must pay a certain amount of money for a license. All states require the owner of an automobile to buy a vehicle license. This kind of license has two purposes. It brings funds into the state treasury, and it identifies the vehicle in case of an accident. Many cities also require vehicle licenses, usually in connection with a system of safety tests for automobiles.

License also is used in law to indicate a qualified right to do something. A *licensee* is a person who has a right, generally, to enter a building or to be on someone else's land for his or her own purposes. For example, a social guest is a licensee. An inventor may grant a license for the use of a patented invention. The license may be *exclusive* (restricted to one party) or *nonexclusive* (granted to more than one party). Jean Appleman

See also **Marriage** (Laws concerning marriage).

Lichen, *LY kuhn,* is an organism that consists of an alga and a fungus living as a single unit. The alga can make its own food with the help of sunlight. The fungus cannot make its own food, but it absorbs water rapidly.

There are about 20,000 species of lichens. Some grow on soil, but most grow on rocks or tree bark. Lichens live in many regions in which few plants can survive. Some species live in the extreme cold of the Arctic. Others live in deserts or on mountains.

Lichens have no roots. They have an outer layer of fungal cells that are pigmented green, brown, yellow, or gray. This protective layer, called the *upper cortex,* covers a zone of green or blue-green algal cells. Below the algal cells lies a food storage zone called the *medulla* and a further protective layer called the *lower cortex.* Most lichens have *rhizines* (fungal strands) that attach the undersurface of the lichen to the tree or rock.

Botanists recognize three groups of lichens. *Fruticose lichens* are shrublike and are attached only at the base to the *substratum* (surface on which they grow). *Foliose lichens* are leaflike in appearance. *Crustose lichens* are crustlike and are attached to the substratum by the whole undersurface.

How lichens grow. Because lichens have no roots, they grow only when moistened by dew or rain. When a moist lichen absorbs sunlight, the algal part produces sugar by *photosynthesis* (see **Photosynthesis**). Most sugar passes to the fungus, which uses it as food, thus enabling the entire organism to grow. Dry lichens do not grow, but they can survive extreme temperatures that kill moist lichens. Most lichens add about 0.1 inch (3 millimeters) a year to their radius, but a few species grow about 10 times as fast. Many crustose lichens grow only .01 inch (0.3 millimeter) yearly. In Arctic regions, these lichens may be as much as 4,000 years old.

Lichens reproduce in three ways. In most lichens, the fungus releases *spores* (microscopic cells) into the air. If a spore lands near a suitable alga, it grows around the alga and a new lichen is formed. Many lichens also reproduce by means of *soredia.* Soredia consist of several algal cells surrounded by a web of fungal strands. They form on the surface of a lichen and are carried away by wind or raindrops. If soredia get trapped in a crack of a tree or rock, they may begin to grow into new lichens. Some lichens produce *isidia* instead of soredia. Isidia are tiny, peg-shaped growths on the lichen's surface. Like soredia, they are broken off and distributed by wind and water.

The importance of lichens. Both animals and human beings benefit from lichens. In the Arctic, lichens cover much of the ground, providing winter food for reindeer and caribou. In other regions, many snails, slugs, and insects eat lichens. In the past, people used lichens as food during famines and as dyes or drugs.

Today, manufacturers use vast amounts of a lichen called *oakmoss* each year. Oakmoss is collected in Europe and North Africa for processing into a *fixative* for perfumes, after-shave lotions, and soaps. The fixative prevents flower fragrances from evaporating quickly. The Scandinavian countries export large quantities of a lichen known as *reindeer moss.* People in Germany and other central European countries make Christmas decorations from this lichen. Another lichen, called *canary weed,* is used to make *litmus,* a substance used to determine if a solution is an acid or a base (see **Litmus**).

For more than 2,000 years, doctors have used drugs made from lichens to treat certain lung and skin disorders. During the mid-1900's, antibiotics were produced from lichens in Scandinavia, Germany, and the Soviet Union. These drugs are now made more economically from fungi.

Scientists use lichens to determine the amounts of certain pollutants in the air. Lichens die when exposed to sulfur dioxide, a poisonous gas that has many harmful effects. Thus, scientists can estimate the amount of sulfur dioxide in the air by observing the number and type of lichens growing at a particular site. Lichens also absorb metals. By analyzing lichens that grow near factories and smelters, scientists can determine the type of metallic pollutants released. D. H. S. Richardson

Scientific classification. Scientists traditionally have classified fungi in the plant kingdom, Plantae. Today, however, many biologists regard fungi as a separate kingdom, called Fungi. They classify lichens in the division Eumycota of this kingdom.

See also Symbiosis.

Lichtenstein, *LIHK tuhn styn,* **Roy** (1923-1997), an American painter, was one of the first artists in the pop art movement. During the early 1950's, Lichtenstein became interested in mass-produced commercial illustrations, especially comic strips and advertisements. He began to isolate single products and single frames of comic strips on a large canvas surface. He thus drew attention to the most common pictorial images in daily life and made them the subjects of art. Many of Lichtenstein's comic strip paintings include words used to describe sounds or a portion of dialogue. These words



Jana R. Jirak

Old man's beard, one of the most unusual lichens, hangs from tree branches. It grows up to 5 feet (1.5 meters) long.



C. P. Armstrong

Yellow map lichens rank among the oldest living things. Scientists believe some of them are thousands of years old.



C. P. Armstrong

Arctic lichens cover much of the ground surface in the tundra. They provide food for caribou and reindeer.

became the titles of the paintings. For examples, see **Pop art** and **Painting** (Pop art).

Lichtenstein eliminated visible brushstrokes from his painting surface. He also tried to duplicate the grainy pattern of newsprint. His paintings are composed of regularly spaced dots of mostly primary colors on white backgrounds with black outlines. As his style developed, Lichtenstein adopted subjects such as other artists' paintings, Greek temples, and sunsets. He also began to create sculptures and prints in his painting style. He was born in New York City. Deborah Leveton

Lick Observatory is an astronomical observatory on top of Mount Hamilton, 50 miles (80 kilometers) southeast of San Francisco. It is part of the University of California Observatories (UCO). Since 1966, its headquarters have been on the campus of the University of California at Santa Cruz.

The observatory includes several buildings that house one or more of its seven telescopes. Housing for scientists and other personnel is also on the mountain, which rises about 4,200 feet (1,280 meters) above sea level. The largest telescope is a reflector with a mirror 120 inches (305 centimeters) in diameter.

The observatory has a refracting telescope more than 100 years old. The telescope has a lens 36 inches (91 centimeters) in diameter and a tube 57 feet (17 meters) long. In 1892, Edward E. Barnard, an American astronomer, discovered the fifth satellite of the planet Jupiter with the telescope.

In 1929, Robert Trumpler of the observatory staff discovered the existence of dust clouds between stars. George Herbig later showed that stars form from the densest of these clouds. In 1969, Joseph Wampler and Joseph Miller used the observatory's 120-inch reflector to make the first photograph of the "flashes" of a *radio pulsar* (see **Pulsar**). Today, astronomers at the observatory conduct research into such subjects as galaxies, bright distant objects called *quasars,* the expansion of the universe, and the origin of the elements.

Critically reviewed by the UCO/Lick Observatory

See also **Cosmology; Telescope.**

Licorice, *LIHK uhr ihs* or *LIHK rihsh,* is an herb that contains both a valuable flavoring and compounds of medicinal value. Its flavoring comes from its long, sweet roots and *rhizomes* (root stems). The roots and rhizomes contain a compound, called *glycyrrhizin,* which is about 50 times as sweet as sugar. Licorice is a *perennial*—that is, it lives for more than one growing season.

Licorice is a native of southern Europe and parts of Asia. The plant grows to about 4 $\frac{1}{2}$ feet (1.4 meters) tall and has dark green leaves. It may be grown from seeds or from cuttings of rhizomes or *stolons* (stems that grow along the ground and take root).

Licorice extracts are used to flavor tobaccos, cigars, cigarettes, soft drinks, and alcoholic beverages. It also serves as a natural sweetener in candy and chewing gum. Licorice extract has traditionally been used to flavor medicines and cough mixtures.

The root fibers remaining after the licorice is extracted are used in making a fire-fighting foam, insulation board, and other products. Commercial licorice is brownish and black and is made by boiling the roots and rhizomes to produce a vapor, then cooling the vapor. It is added to licorice candy to provide the traditional black color and sweetness. The licorice flavor, however, actually comes from *anethole,* a compound found in anise, fennel, and other herbs. James E. Simon

Scientific classification. Licorice belongs to the pea family, Fabaceae or Leguminosae. The licorice plant most valuable commercially is *Glycyrrhiza glabra.*

Lidice, *LIHD uh see,* was a village in Czechoslovakia that German military forces destroyed in an act of revenge during World War II (1939-1945). Lidice became a symbol of Nazi cruelty.

German troops occupied Czechoslovakia in 1938 and 1939. In May 1942, Reinhard Heydrich, a Nazi who played a key role in the Holocaust and controlled much of the country, was fatally wounded. The Nazis claimed that residents of Lidice helped kill Heydrich. But no evidence was found to support this claim. On June 10, 1942, the Germans shot all of Lidice's 192 men. The Nazis sent about 200 women and about 100 children to concentration camps. There, more than 50 of the women and more than 80 of the children were killed. The village was torn down. After the war, some of the survivors built a new village called Lidice near the original site, near Prague, in what is now the Czech Republic. For location, see **Czech Republic** (map). The original site now serves as a memorial to the sufferings of Czechoslovakia under German occupation. Donald M. McKale

Lidocaine, *LY duh kayn,* is a drug that can block pain sensation in a specific part of the body. Such drugs are called *local anesthetics.* Physicians use lidocaine to numb a certain part of the body before surgery or to treat pain associated with injuries or disease.

Lidocaine may be applied directly to the skin, throat, or lining of the nose, or it may be injected around nerves. Injection around the lower spinal cord helps control pain during childbirth or surgical procedures involving the lower parts of the body.

Lidocaine stops sensation in a certain area by interfering with electrical impulses that travel along nerve fibers. The resulting loss of sensory function is called a *nerve block.* Feeling returns to the blocked area when the drug's effect wears off. Physicians sometimes inject lidocaine to correct abnormal heart rhythms in heart attack victims and in patients who have a heart condition called *arrhythmia.* The drug acts on the nerves that carry electrical impulses to the heart. Richard W. Sloan

See also **Anesthesia** (Local anesthesia).

Lie, *lee,* **Trygve,** *TRIHG vuh* (1896-1968), a Norwegian statesman, served as the first secretary-general of the United Nations. He was elected for five years in 1946, and was continued in office for three years in 1950. He announced his resignation in 1952, and left office in April 1953. The Soviet Union opposed Lie because he supported the UN's action in South Korea. Lie resigned hoping to lessen international tensions.

Trygve Lie was born on July 16, 1896, in Oslo. He brought experience and talent in handling political problems to his UN position. Lie had become Norway's minister of justice in 1935. From 1939 to 1941, during World War II, he served as minister of trade and supply in the Norwegian government-in-exile in England. From 1940 to 1946, he served as minister of foreign affairs. Also during the war, which ended in 1945, he helped manage supplies for the small Norwegian military force that fought against Germany. In 1945, he led Nor-

way's delegation to the UN Conference in San Francisco, where he helped draw up the charter for the UN Security Council. Byron J. Nordstrom

See also **United Nations** (picture).

Lie detector is a device that helps determine whether a person is telling the truth. A lie detector, also called a *polygraph,* records physical changes that occur in reaction to questions. Such changes include alterations in the blood pressure, pulse rate, perspiration, and respiration that may occur when an individual lies. Lie detectors help police and other investigators question suspects about their possible involvement in a crime. The devices also help retail stores and other employers screen job applicants and investigate employee theft.

Polygraph experts and other supporters of lie detector testing believe that such tests are highly accurate. Some court cases are decided on the basis of lie detector tests, which can be used as evidence if all people involved agree beforehand to their use. But many legal experts believe that testimony obtained with the aid of lie detectors is not accurate enough to be used in court. These experts also say that such testimony may violate the Fifth Amendment to the United States Constitution, which protects people from testifying against themselves. The judges in most criminal cases do not permit testimony obtained with lie detectors to be used as evidence.

No one can be required to take a lie detector test in any criminal matter. A person who agrees to do so is connected to a polygraph and sits in a chair while answering questions. The lie detector records the person's pulse rate, blood pressure, breathing, and perspiration. It makes a continuous record of these body functions by drawing lines on a moving graph.

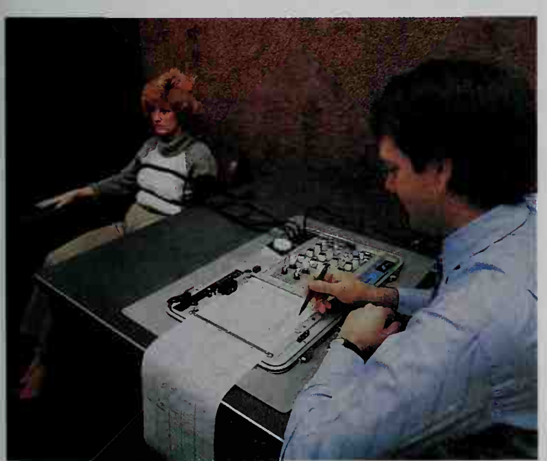
Some of the questions asked during a lie detector test are related to the matter being investigated. Others are unrelated or only slightly related, but they are included to improve the test's accuracy. Each question must be answered yes or no. If a person lies, the graph normally shows a change in one or more of the body functions being recorded. This change occurs because of the individual's emotional response to telling a lie. A lie detector examiner interprets the test results.

In 1921, John A. Larson, an American psychologist, developed one of the first lie detectors. In 1966, a number of lie detector organizations formed the American Polygraph Association. The association helps supervise the use of lie detectors and establishes qualifications for the examiners. In 1972, the American inventor Allen Bell developed a device called a *psychological stress evaluator.* This instrument detects slight tremblings in the voice, which may be interpreted to determine if a person is telling the truth. Most experts agree that the device is not completely accurate, but that it is useful when used together with a polygraph. John I. Thornton

Lieberman, *LEE bur muhn,* **Joseph Isadore** (1942-), a United States senator from Connecticut, was the Democratic nominee for U.S. vice president in 2000. In an extremely close contest, he and his running mate, Vice President Al Gore, lost to their Republican opponents, Texas Governor George W. Bush and former U.S. Secretary of Defense Richard B. Cheney. Lieberman, an Orthodox Jew, was the first Jewish vice presidential candidate of a major American political party.

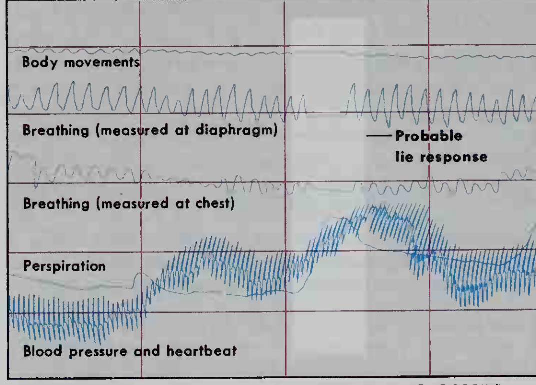
Lieberman began representing Connecticut in the U.S. Senate in 1989. As a senator, he has criticized violence on television and in rap music and video games. He encouraged those industries to voluntarily reduce such violence so legislation to restrict it would not be necessary. He supported an increase in the legal minimum wage, which was enacted in 1996.

Lieberman was born in Stamford, Connecticut. He received a bachelor's degree in 1964 and a law degree in 1967, both from Yale University. He served in the Connecticut state Senate from 1971 to 1981 and was majority leader from 1975 to 1981. In 1980, he ran for the U.S. House of Representatives but lost the election. He served as Connecticut's attorney general from 1983 to 1988. He was first elected to the U.S. Senate in 1988. Lieberman has written several books, including *Child Support in America* (1986) and *In Praise of Public Life* (2000). Lee Thornton



Frazier Photo Library

A lie detector measures and records a person's physical reactions to questions. Such reactions include changes in various body functions that may occur when an individual lies.



WORLD BOOK diagram

A lie detector graph shows how certain body functions change when lying occurs. If the person being tested tells the truth, the graph normally reflects little or no change in the functions being recorded, as shown in the shaded area. If the person lies, the graph normally indicates a change in one or more of these functions, as shown in the unshaded area.

Liechtenstein, *LIHK tuhn STYN,* is a tiny country in south-central Europe. It is one of the world's smallest countries. Liechtenstein covers only 62 square miles (160 square kilometers) and has only about 34,000 people.

Liechtenstein lies along the Rhine River between Switzerland and Austria, and has many close ties with the Swiss. Most of the people speak Alemannic, a German dialect. Liechtenstein uses Swiss money, and Switzerland operates its postal, telegraph, and telephone systems. Switzerland also represents Liechtenstein in the country's diplomatic and trade relations.

Like Switzerland, Liechtenstein has maintained its neutrality through several wars. Liechtenstein has not fought in a war since 1866. It has been independent since 1806. Its official name in German, the official language, is Fürstentum Liechtenstein (Principality of Liechtenstein). Vaduz is the capital and largest town.

Government. Liechtenstein is a constitutional monarchy. It is ruled by a prince who is the head of the House of Liechtenstein. The throne usually passes to the prince's eldest son.

The people elect the 25 members of the Landtag (parliament) to four-year terms. The Landtag passes laws, prepares the national budget, and sets tax rates. Laws must be approved by the prince. A five-member Collegial Board headed by a prime minister handles government operations. Its members are nominated by the Landtag and approved by the prince. Liechtenstein has two political parties, the Patriotic Union and the Progressive Citizen's Party.

People. The people in Liechtenstein, like the Austrians and Swiss, are descended from a Germanic tribe that settled in the Alps in the A.D. 400's. Until the 1930's, most people farmed for a living. Now, more than half of them are factory workers or craftworkers. Less than 10 percent of the people still farm for a living.

Almost all the people are Roman Catholics. Primary and secondary schooling is free, and children must attend school for eight years. Nearly all adults in Liechtenstein can read and write.

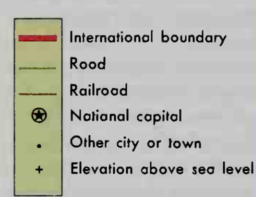
One of the world's finest private art collections is owned by the prince. It is housed in Vaduz and includes works by Pieter Bruegel the Elder, Sandro Botticelli, Rembrandt, and Peter Paul Rubens.

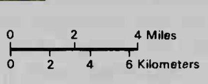
Facts in brief

Capital: Vaduz.
Official language: German.
Area: 62 mi² (160 km²). *Greatest length*—17.4 mi (28 km). *Greatest width*—7 mi (11 km).
Elevation: *Highest*—8,527 ft (2,599 m). *Lowest*—1,411 ft (430 m).
Population: *Estimated 2002 population*—34,000; density, 548 per mi² (213 per km²); distribution, 80 percent rural, 20 percent urban. *1980 census*—25,215.
Chief products: *Agriculture*—beef and dairy cattle, fruits and vegetables, wheat. *Manufacturing*—ceramics, electronic equipment, fabricated metal products, heating appliances, pharmaceutical products.
Flag: Two horizontal stripes, the upper one blue (for the sky), the lower one red (for the glow of evening fires). A crown representing the prince appears in the upper left. See Flag (picture: Flags of Europe).
Money: *Basic unit*—Swiss franc. One hundred centimes equal one franc.

Liechtenstein







WORLD BOOK maps

Land. The Rhine River flows along the western border of Liechtenstein. A narrow strip of flat farmland lies next to the river. Snow-topped mountains cover most of the country's eastern and southern sections. The mountain slopes are covered with pine forests and fine grazing meadows.

Liechtenstein has a mild climate for a country surrounded by high mountains. Warm spring winds provide good weather for growing fruit. The average yearly temperature is 47 °F (8 °C), and precipitation averages about 35 inches (89 centimeters) a year.

Economy. Since about 1950, Liechtenstein has changed from a farming country to a highly industrialized one. It has one of the highest standards of living in the world. In 1991, Liechtenstein joined the European Free Trade Association, an economic organization of European nations.

Products made in Liechtenstein include ceramics, electronic equipment, fabricated metal products, heating appliances, and pharmaceutical products. Farmers raise beef and dairy cattle in upland meadows, grow grapes and other fruits on upland slopes, or grow wheat or corn, potatoes, and other vegetables in the Rhine Valley. About 5,000 of the 12,000 workers in Liechtenstein's industries come from neighboring countries.

The government collects money by taxing foreign businesses that set up their headquarters in Liechtenstein. Liechtenstein offers low business and income taxes to such companies, and over 5,000 firms from other countries have established headquarters there. The government also makes money by selling postage stamps. Liechtenstein's stamps are prized by stamp collectors throughout the world. Many of the stamps are reproductions of paintings in the prince's famous art collection. Tourism is also an important source of income for Liechtenstein.

Liechtenstein has two hydroelectric plants that produce electric power for the country. It also sells some power to Switzerland. Trains on the main railroad line from Switzerland to Austria go through Liechtenstein.

But only a few trains stop in Liechtenstein. Buses link Liechtenstein with Austria and Switzerland.

History. Because of its central location in Europe, the area that is now Liechtenstein has been continuously inhabited since 3000 B.C. Charlemagne, king of the Franks, controlled the area in the late A.D. 700's. After his death in 814, the region was divided into two independent states, Vaduz and Schellenberg. Both states later became part of the Holy Roman Empire. Johann-Adam Liechtenstein, a prince from Vienna, acquired Schellenberg in 1699 and Vaduz in 1712. His descendants still rule Liechtenstein.

Liechtenstein has been an independent state since 1719, except for a brief period during the early 1800's when Napoleon I of France controlled it. In 1815, Liechtenstein joined the German Confederation, a league of German rulers, but kept its independence. The confederation was dissolved in 1866 at the end of the Seven Weeks' War. This was the last war in which Liechtenstein fought. It has remained neutral since then and has had no army since 1868. In 1924, Liechtenstein agreed on an economic union with Switzerland.

Until 1984, only men were allowed to vote in Liechtenstein's elections. Women were given the right to vote in national elections that year, though they are still not permitted to vote in many local elections. Prince Franz Josef II died in 1989. He was succeeded by his son Prince Hans Adam, who had ruled in his place since 1984. Janet L. Polasky

See also **Vaduz**.



© Porterfield-Chickering, Photo Researchers

Vaduz, Liechtenstein's capital, lies on the west side of the country. The castle on the cliff overlooking Vaduz's main street is the home of the prince of Liechtenstein.

Lieder, *LEET uhr* or *LEE duhr,* is the German word for *songs.* The term refers particularly to art songs written by German composers of the romantic era from the late 1700's to the early 1900's. Franz Schubert was probably the most important composer of lieder. Others included Robert Schumann, Johannes Brahms, Hugo Wolf, Richard Strauss, and Gustav Mahler. Most lieder were written for voice and piano accompaniment. Most express a love of nature and the simple things of life and were composed to words of German romantic poets, including Goethe and Heinrich Heine. John H. Baron

Liège, *lee AYZH* (pop. 195,389), is a city in eastern Belgium. It lies on both banks of the Meuse River, in the French-speaking part of Belgium (see **Belgium** [political map]).

Liège has many iron and steel factories and zinc smelters that work closely with nearby mines. The city is famous for the manufacture of guns and glassware. Liège has a university that was founded in 1817. It is a leading cultural center of Belgium. Opposing armies fought bitterly for control of Liège in World Wars I and II because of its strategic location and its products.

Aristide R. Zolberg

Lien, *leen,* is a legal claim that one person has on the property of another as security for debt. The main types of liens are *common-law liens* and *statutory liens.* Common-law liens developed from judges' decisions in similar cases. Statutory liens are defined by laws passed by legislatures. A *mechanic's lien* is an example of a statutory lien. This lien gives building contractors assurance that they will be paid for their work and material.

Common-law liens may be either *specific* or *general.* A specific lien gives the holder the right to retain the property that is the basis for the debt that is owed. For example, a storage company owner may obtain a specific lien to hold goods stored by the company until the storage is paid for. A general lien gives the holder the right to property other than that which is the basis of the debt due. James E. Krier

Lieutenant governor is a government official in the United States and Canada. In many U.S. states, the lieutenant governor ranks second to the governor. The lieutenant governor serves as governor if the governor dies, resigns, is impeached, or is unable to carry out the duties of the office. The official is elected at the same time as the governor, and for the same term.

The lieutenant governor presides over the state senate in 28 of the 34 states that have lieutenant governors. In this position, the lieutenant governor's powers resemble those of the Speaker in the lower house of the state legislature.

In Canada, each province has a lieutenant governor. The official is appointed by the governor general in council of Canada and represents the United Kingdom's head of state in the province. The position of the lieutenant governor, like that of the governor general, is largely ceremonial. David R. Berman

See also **Canada, Government of** (Provincial and territorial governments); **Governor.**



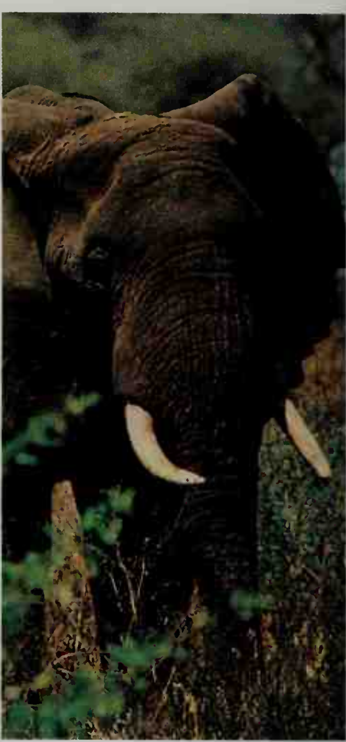
Manfred Kage from Peter Arnold



© Raymond A. Mendez, Earth Scenes



© Karl Weidmann, Animals Animals



Marvin Newman, Woodfin Camp, Inc.

The earth's incredible variety of living things includes tiny one-celled organisms like the amebas, *upper left,* as well as huge animals like the elephant, *right.* The cactus, *lower left,* and the praying mantis, *center,* represent the two largest groups of living things—plants and insects.

Life

Life. People generally have little difficulty distinguishing living things from nonliving things. For example, they easily recognize that a butterfly, a horse, and a tree are alive but a bicycle, a house, and a stone are not. People call a thing living if it is capable of certain activities, such as growth and reproduction.

Biologists, however, find it hard to define life, though they have vast knowledge of living things. They have difficulty locating the dividing line between living and nonliving things. For example, a virus is a lifeless particle by itself, but it becomes active and multiplies rapidly when inside a living cell. Rather than trying to define life precisely, biologists concentrate on deepening their understanding of life by studying living things.

The earth has an enormous variety of living things—more than 10 million species. They range in size from microscopic bacteria to gigantic blue whales and towering sequoia trees. Living things can be found in all kinds of environments. Some organisms live in sun-scorched deserts. Others flourish in icy polar waters. Still others thrive in steamy jungles. Living things also vary widely in their behavior and food requirements. In spite of their differences, however, all living things consist of the same kinds of chemicals and carry out the same kinds of chemical reactions.

Scientists have long sought definite answers to two major questions about life: "How did life begin on the earth?" and "Does life exist elsewhere in the universe?" Research into these matters is underway both on the earth and in space. This research should help experts begin to formulate scientific theories that can be tested through experiments.

Harold J. Morowitz, the contributor of this article, is Robinson Professor of Biology and Natural Philosophy at George Mason University. He is the author of Energy Flow in Biology *and other books on biology.*

The characteristics of living things

Nearly all living things share certain basic characteristics. These characteristics include (1) reproduction; (2) growth; (3) metabolism; (4) movement; (5) responsiveness; and (6) adaptation. Not every organism exhibits all these features, and even nonliving things may show some of them. However, these characteristics as a group outline the basic nature of living things.

Reproduction is the process by which living things create more of their own kind. There are two major types of reproduction—*asexual* and *sexual.* In asexual reproduction, a new organism develops from one existing organism. Some lower organisms, including bacteria, reproduce asexually. In sexual reproduction, a new organism develops from the union of two sex cells. In most cases, these cells come from two parents—a male and a female. Human beings and most higher animals and plants reproduce sexually. See **Reproduction**.

Growth is the orderly increase in size that organisms undergo as they mature. Plants grow by taking in simple

molecules, such as carbon dioxide and water, and chemically converting them into complex plant materials. Animals grow by eating food and converting it into animal tissue. Biological growth differs from *accretion.* In this process, some nonliving things increase in size through the addition of new layers to their surfaces. For example, a salt crystal becomes larger through the accumulation of new layers of salt. See **Growth.**

Metabolism involves all the chemical processes by which an organism converts molecules and energy into forms that it can use. Metabolism supplies the molecular building blocks an organism needs for the growth of new tissues and the replacement of worn-out parts. These building blocks must either come from the breakdown of food material or be built up from simpler molecules within the organism.

Biological energy comes chiefly from sunlight. The energy is trapped by plants during the process of *photosynthesis* and stored in chemical compounds. All other biological activities in animals and plants depend on conversions of this energy into useful forms. Most such conversions occur in an organism through the combination of food with oxygen. This process, called *oxidation,* produces water, carbon dioxide, and many molecules of a high-energy compound called *adenosine triphosphate (ATP).* ATP molecules hold energy in its most biologically useful form and release the energy as it is needed. See **Metabolism.**

Movement. Most living things move in some way. Plants have internal motions, such as the flow of sap. A plant may also bend toward the light, and its flowers may close at night. Movement is more obvious in most animals. Some animals, however, move only internally. For example, a sponge circulates water laden with food particles through its otherwise stationary body.

Responsiveness. Living things can sense and respond to changes in their surroundings. Changes that produce responses in organisms are called *stimuli.* Such factors as light and temperature can serve as stimuli. The responses of organisms take various forms, most of which involve some type of movement. For example, a turtle can contract into its shell, a plant can grow toward the sunlight, and a bacterium can swim away from concentrations of harmful substances.

Adaptation is a characteristic of an organism that makes it better able to survive and reproduce in its environment. An adaptation may involve changes in the organism's *genes* (units of heredity), which are passed on from generation to generation. Such changes are known as *mutations* (see **Mutation**). To survive, living things must adapt to long-term changes in the environment. For instance, adaptations through mutations have made some species of insects resistant to certain insecticides (see **Natural selection**). Living things also must adapt to varying short-term conditions in the environment. For example, when a person travels to a foreign country, the body may have to adjust to a different altitude, climate, or diet. See **Adaptation.**

Living things and their environment

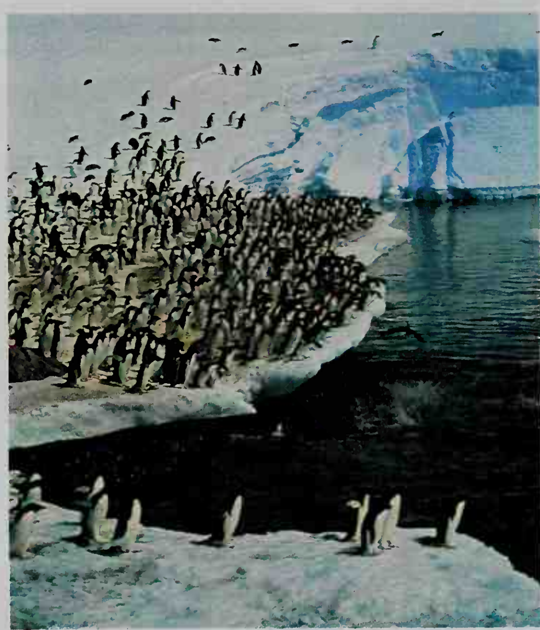
Living things depend greatly on their physical surroundings and on other living things. An organism's environment must provide certain conditions for it to survive. For example, all living things require water and many other chemical substances. In addition, life as we know it can exist only within a limited range of temperatures. Conditions capable of supporting life occur on and near the surface of the earth in a thin region called the *biosphere* or *zone of life.*

The study of the relationships between living things and their environment forms the science of *ecology.* Such features as geological formations, climate, and soil make up an organism's *physical environment.* The other living things in the same area form the organism's *biological environment.* See **Ecology.**

The physical environment determines which kinds of plants and animals can live in a given place. In general, areas with a warm climate and plenty of water have a great variety of living things. However, only specially adapted species can live in extreme environments. For example, the penguins of Antarctica have few neighbors in their bitter cold climate. Only a few kinds of algae and bacteria can live in hot springs, where temperatures may reach 185 °F (85 °C).

The biological environment. All members of a given species living in a particular area form a *population.* All animal and plant populations that inhabit the area make up a *community.* The populations in a community relate to one another in many ways. In the most basic relationship, organisms obtain nutrients and energy by eating other organisms. Some kinds of animals eat plants, and others feed on animals. In addition, some types of bacteria and fungi get nutrients and energy from the decaying remains and waste matter of other organisms. Other relationships in a community include (1) competition; (2) parasitism; and (3) mutualism.

Competition occurs when two or more organisms require the same resource, such as food or nesting space.



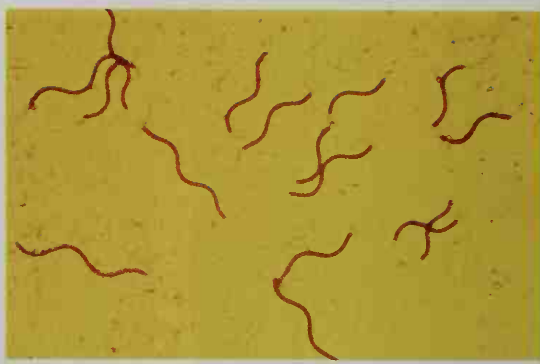
© C. Haagner, Bruce Coleman Inc.

Penguins have become specially adapted for life in icy waters. Thick layers of fat keep them warm, and their wings have developed into flippers that enable them to swim but not to fly.

The competition may take place between individuals from different populations or between organisms of the same population.

Parasitism occurs when one organism lives in or on another organism, called a *host.* The parasite takes its food from the tissues or digestive system of the host. For example, a tapeworm absorbs digested food from the intestines of its host.

Mutualism is an association between two organisms of different populations that benefits both organisms. For example, two organisms—an alga and a fungus—may live together as a unit called a *lichen.* The alga can make its own food, but it must have water to grow. The fungus absorbs water well, but it cannot produce its own food.



Runk/Schoenberger from Grant Heilman

The simplest living things, such as the bacteria shown above, consist of a single cell that lacks a distinct nucleus.

The structure of living things

All living things are made up of cells. The simplest organisms consist of only one cell, but such complex living things as dogs and human beings have many billions of cells.

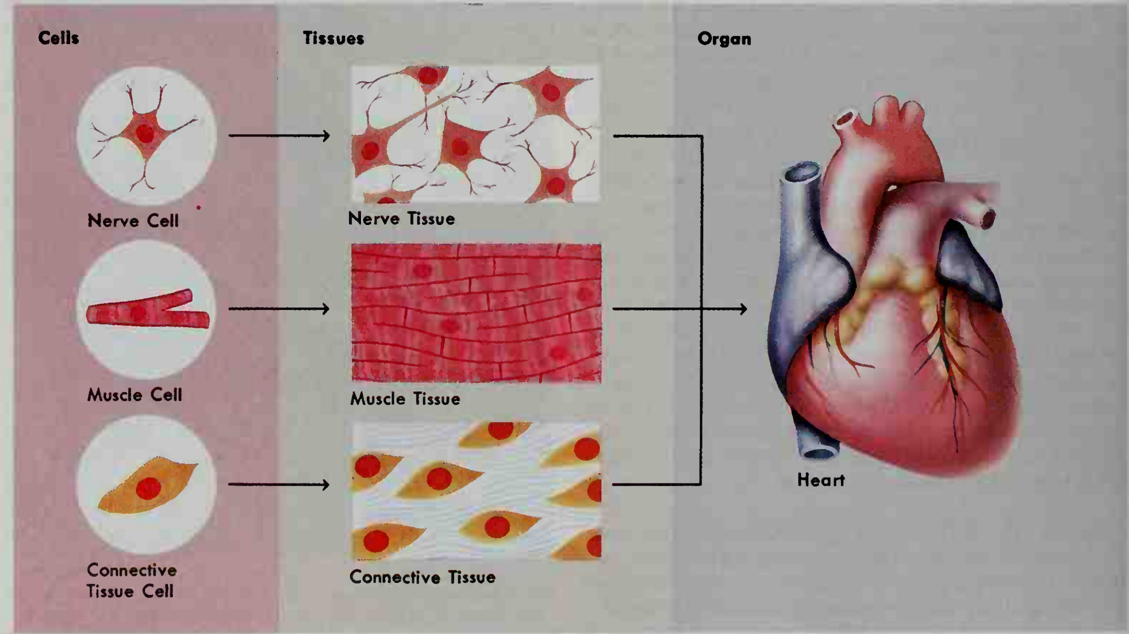
The simplest organisms, including bacteria and many kinds of algae and protozoans, live their entire lives as individual cells. Some other types of algae and protozoans are *colonial* organisms. Such an organism consists of a loosely organized group of similar cells. Most species of animals and plants are *multicellular* organisms. They are made up of many kinds of cells, each having its own special functions.

The simplest multicellular animals include sponges and jellyfish. Sponges have some specialized cells but resemble colonial organisms. If the cells of a sponge are separated, they can readily rejoin and form a new individual. Jellyfish are somewhat more highly organized and have well-defined tissues. Higher animals have organs and organ systems.

Cells. A thin covering called the *plasma membrane* or *cell membrane* encloses every cell and separates it from its surroundings. All cells except those of bacteria have two main parts—the *nucleus* and the *cytoplasm.* A *nuclear membrane* surrounds the nucleus and separates it from the cytoplasm. The nucleus contains the *chromosomes,* the hereditary material that carries the instructions for nearly all cellular activities. The cytoplasm contains many kinds of specialized structures called *organelles.* Each type of organelle has a specific task, such as manufacturing proteins or converting the energy of food molecules into usable forms.

Structural units of higher organisms Higher organisms have many specialized kinds of cells. Cells that are similar in structure and function make up a tissue. Tissues, in turn, are grouped together and form organs, which are the basic structural and functional units of higher plants and animals. The illustration below shows the main types of cells and tissues that make up the human heart.

WORLD BOOK diagram by Charles Wellek



Organelles and a well-defined nucleus are lacking only in the cells of bacteria. Such cells are called *prokaryotic,* which means *before the nucleus.* Biologists refer to all other cells as *eukaryotic,* which means *having a true nucleus.* For a detailed discussion of cells, see **Cell** (Inside a living cell).

Tissues, organs, and organ systems. Higher organisms have many extremely specialized kinds of cells, which are grouped together and form larger, more complex structures. A *tissue* consists of a collection of cells that are similar in structure and function. Animal tissues include muscle tissue and nerve tissue. Plants also have several kinds of tissues. For example, tissue called *xylem* carries water and minerals from the roots to the rest of the plant.

The basic structural and functional units of higher organisms are *organs.* An organ consists of several types of tissues. The human heart, for example, consists of muscle tissue, nerve tissue, and connective tissue. Other animal organs include the brain, liver, and kidneys. The principal organs of flowering plants are roots, stems, leaves, and flowers. In higher animals, each important life function is carried out by a group of organs working together. Such a group is called an *organ system.* Major organ systems include the circulatory system, digestive system, and reproductive system.

The chemical basis of life

All the chemical elements that make up living things are also present in nonliving matter. The most common elements in living things are carbon, hydrogen, nitrogen, oxygen, phosphorus, and sulfur. Living things also contain smaller amounts of other elements, including calcium, iron, magnesium, potassium, and sodium.

Water is the simplest chemical compound of importance to living things. Most organisms consist of 50 to 95 percent water. Many properties of water make it essential to life processes. Its ability to dissolve a great variety of substances is vital because most chemical reactions within organisms can occur only in a water solution. In addition, water itself enters into many chemical reactions in living cells. Water also transports nutrients within organisms.

Except for water, all the principal compounds in living things contain carbon. Compounds that contain carbon are called *organic compounds.* Those that do not contain carbon are called *inorganic compounds.* Each carbon atom can form four chemical bonds of great stability with other atoms. Carbon atoms can also bond with one another and form chains of various lengths and shapes. These properties appear to be unique to carbon, and so it is hard to imagine life as we know it based on anything except carbon chemistry.

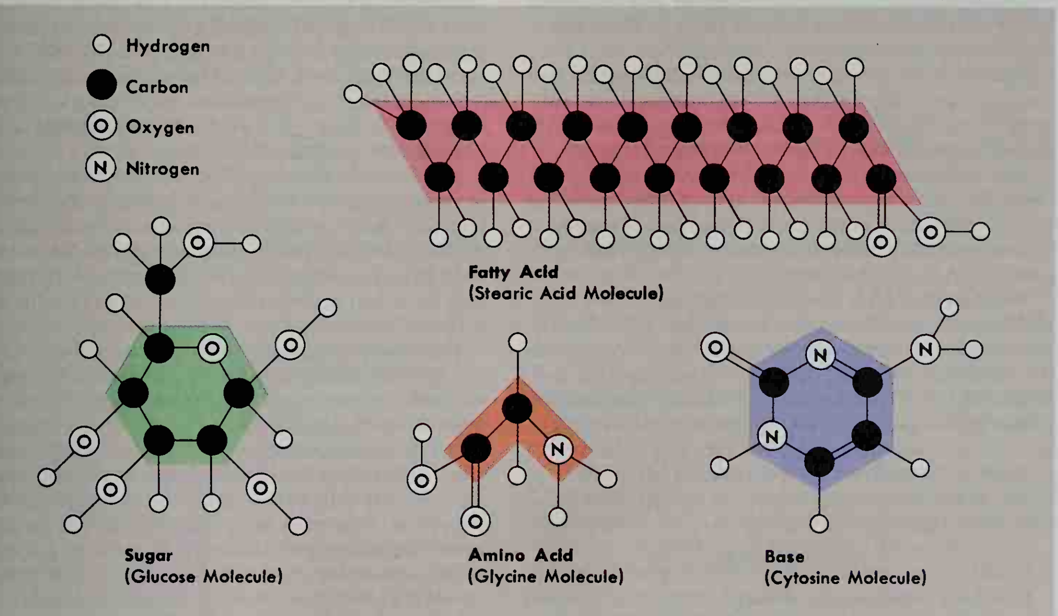
Carbon can form thousands of kinds of small molecules. However, almost all living material consists of about 50 kinds of carbon molecules and of the *macromolecules* (large, complex molecules) formed from them. There are four main types of these macromolecules. They are (1) carbohydrates; (2) lipids; (3) proteins; and (4) nucleic acids.

Carbohydrates consist of carbon, hydrogen, and oxygen. The basic carbohydrate molecules are simple sugars called *monosaccharides.* Sugars provide energy to power all cellular processes.

Living things combine simple sugars into long chains called *polysaccharides.* Some polysaccharides serve as

The importance of carbon in life The ability of carbon atoms to form chains of various lengths and shapes is fundamental to the chemistry of life. The four main types of biological molecules—carbohydrates, lipids, proteins, and nucleic acids—consist of smaller carbon-containing molecules like those below. Sugars are found in carbohydrates, fatty acids in lipids, amino acids in proteins, and bases in nucleic acids.

WORLD BOOK diagram by Steven Liska



a means of food storage. Starches are the main carbohydrate storage material in plants, and *glycogen* serves the same function in animals. Other polysaccharides provide structural support. The polysaccharide *cellulose* is the chief supporting material in green plants. Wood consists largely of cellulose. See **Carbohydrate.**

Lipids consist primarily of carbon and hydrogen, but they also contain a small proportion of oxygen. Some contain nitrogen and phosphorus as well. The best-known lipids are animal fats and vegetable oils. Many kinds of organisms store food in the form of lipids.

Other important lipids, such as *phospholipids* and *steroids,* have more complicated structures than do fats and oils. Phospholipids contain phosphorus, and some also contain nitrogen. Layers of phospholipids form the basic structure of cell membranes. Steroids consist of four connected rings of carbon atoms with other atoms and molecules attached. Steroids include such substances as sex hormones, adrenal hormones, and cholesterol. See **Lipid.**

Proteins are far more complex molecules than carbohydrates or lipids. A protein is made up of one or more long chains called *polypeptides.* Polypeptides consist of many small molecules called *amino acids.* All amino acids contain carbon, hydrogen, nitrogen, and oxygen. Some also contain sulfur. There are 20 amino acids found in proteins. Each protein molecule may have from about 50 to over 1,000 amino acid molecules.

Proteins are the most abundant macromolecules in living cells. The many kinds of amino acids and the large number of them in each protein molecule make possible an enormous variety of proteins. Each arrangement of amino acids has different chemical properties and different functions. Proteins can thus carry out a vast range of tasks. Some proteins, such as *keratin* in hair and *myosin* in muscle, form the major structural material in many living things. Other proteins have chemical functions. Most such proteins are enzymes, which speed up chemical reactions within cells. Enzymes also determine which chemical reactions will take place in a cell. See **Protein; Cell** (Producing proteins); **Enzyme.**

Nucleic acids store and transmit the information necessary for producing proteins. Nucleic acids consist of long chains of smaller molecules called *nucleotides.* The nucleotides are made of carbon, hydrogen, nitrogen, oxygen, and phosphorus. There are various types of nucleotides, which together compose a sort of code for expressing genetic messages. These messages completely control a cell's structure and activities by determining which proteins will be produced.

There are two main types of nucleic acids, *DNA* (deoxyribonucleic acid) and *RNA* (ribonucleic acid). DNA is the genetic substance in the chromosomes. DNA carries the hereditary information that an organism passes on to its offspring. This information determines the kinds of proteins a cell produces. RNA transmits DNA's instructions to the cytoplasm, where it serves as a pattern for building proteins. For a fuller discussion of nucleic acids, see **DNA; RNA; Cell** (The code of life); **Heredity** (The flow of genetic information).

The origin of life

Religious explanations. Nearly all religions have had *creation stories* to explain the origin of life. In the Western world, the best-known creation story comes from the Book of Genesis in the Bible. It tells how God created the earth and all living things.

Modern religious thinkers interpret the Biblical story of creation in various ways. Some believe that the creation occurred exactly as Genesis says it did. Others think that the story is a symbolic account of creation, which is a divine mystery that will never be fully understood. Still other religious scholars believe that God's method of creation is revealed through science and human understanding.

The theory of spontaneous generation originated in ancient times and remained a common belief for thousands of years. The theory claimed that lower forms of life could arise from nonliving matter. For example, people believed that flies developed from decaying meat and that mice formed from piles of old rags.

During the mid-1600's, an Italian scientist named Francesco Redi conducted experiments showing that meat protected from flies would not produce maggots. However, Redi's experiments did not end the dispute over spontaneous generation. A belief persisted that microscopic forms of life could arise spontaneously, and the argument raged for about 200 years.

The French chemist Louis Pasteur finally settled the controversy during the mid-1800's. He demonstrated that even the minutest bacteria do not arise spontaneously but always grow from other bacteria. After Pasteur's experiments, most biologists accepted the idea that all life comes from existing life. See **Spontaneous generation.**

Modern theories. During the 1900's, biologists have developed scientific theories of the origin of life. Scientists think that life probably arose on the earth more than $3\frac{1}{2}$ billion years ago, and so they cannot base their understanding of that event on direct observation. As a result, their understanding of how life began is far less certain than their knowledge of such subjects as cell structure and biochemistry. Scientists construct explanations of the origin of life. They base their explanations on their knowledge of living things and on their understanding of the early physical conditions on the earth.

Scientists have proposed two major theories of the origin of life. They are (1) the theory of panspermia and (2) the theory of chemical evolution.

The theory of panspermia states that spores from some other part of the universe landed on the earth and began to develop. However, some scientists doubt that spores could survive a journey through the harsh conditions of outer space. Even if the theory is true, it explains only the origin of life on the earth and not how life arose in the universe.

The theory of chemical evolution was developed independently during the 1920's by Soviet biochemist Alexander I. Oparin and by J. B. S. Haldane, a British biologist. According to this theory, life developed through a series of spontaneous chemical reactions in the atmosphere and oceans early in the earth's history. Oparin and Haldane based their views on the assumption that the atmosphere of the early earth contained little or no *free* (uncombined) oxygen. Because hydrogen is the most abundant element in the universe, they theorized that the earth's early atmosphere contained large quantities of hydrogen. Under such conditions, the hydrogen-



Sigurgeir Jonasson

Lightning and volcanoes may have played a role in the origin of life on the earth. According to one theory, energy from such sources as lightning, volcanoes, and sunlight powered reactions among the gases in the atmosphere of the early earth. The theory proposes that such reactions produced the first biological molecules in the form of sugars and amino acids.

containing compounds ammonia, formaldehyde, hydrogen cyanide, methane, and water would also have been abundant. The early theory of chemical evolution proposed that energy from such sources as sunlight, lightning, and volcanoes powered reactions among these compounds that produced simple biological molecules, such as sugars and amino acids.

Two American chemists, Stanley L. Miller and Harold C. Urey, provided the first experimental evidence in support of the theory of chemical evolution in 1953. They subjected a mixture of ammonia, hydrogen, methane, and water to the energy of high-voltage sparks for one week. After that time, amino acids and other simple biochemical compounds had formed. Scientists have repeated this experiment under various conditions. For example, some researchers have assumed that the early atmosphere contained little hydrogen but large quantities of carbon dioxide. They have replaced the hydrogen-rich "atmosphere" of the Miller-Urey experiment with various mixtures high in carbon dioxide and relatively low in hydrogen. These mixtures have also yielded biochemical compounds when exposed to sparks of energy.

Other organic compounds on the early earth may have come from carbon-rich meteorites known as *carbonaceous chondrites.* Several such meteorites have been found to contain simple organic compounds.

Scientists have developed three major theories to explain the transition from early organic molecules to living cells. All three theories are based on the idea that the simple organic compounds formed more complex ones, which then gave rise to the structures that make up cells. The oldest of these theories states that chemical reactions in the ocean or in lakes led to the formation of large molecules. These molecules then acted as *catalysts* (substances that speed up chemical reactions) to cause the formation of complex organic compounds. A second view holds that chemical reactions producing the first complex organic compound took place on the surfaces of clays or of minerals called *pyrites.* In this view, the clays or pyrites acted as catalysts.

A third theory is based on the facts that cell-like structures with membranes will form spontaneously in mixtures of certain lipids and water and that such structures fold into shells the size of small cells. This theory claims that the chemical reactions leading to the formation of complex organic compounds took place inside and on the surface of these shells. Scientists are experimenting to determine which, if any, of these theories corresponds most closely to the known facts.

Most scientific research supports—or at least does not contradict—the idea that life arose through chemical evolution. For example, the surface of the earth experiences a continuous flow of energy as it gets light from the sun and radiates heat into outer space. Physics research has demonstrated that such an energy flow increases molecular organization. Thus, the evolution of complex biochemical molecules may be viewed as part of this natural process.

Although scientists have experimental evidence to support parts of the theory of chemical evolution, many questions remain. One example is the question of how biological molecules could have become organized into cell-like organisms. Biologists are also trying to discover how nucleic acids and proteins became related in such a way that nucleic acids determine the kinds of proteins a cell produces. A complete theory of the origin of life will have to explain this relationship, which is a basic characteristic of life as we know it.

The search for life on other planets

The theory of chemical evolution suggests that life arises naturally under certain physical and chemical conditions. Astronomers believe that these conditions have probably existed in many places throughout the universe. Thus, many scientists conclude that life may have arisen on numerous other planets. The search for and study of life elsewhere in the universe make up the science of *exobiology.* See **Exobiology.**

Exobiologists think that the chemistry of life anywhere in the universe would basically resemble that of life on the earth. However, the living things on another planet would have developed in response to the specific environmental conditions there. As a result, the life forms would almost certainly differ greatly in structure and appearance from those on the earth.

The development of space travel during the 1960's provided the opportunity to search for life on neighboring planets in our solar system. At that time, scientists thought that life might exist on two of those planets—Venus and Mars. The harsh environments on the other planets in our solar system make it highly unlikely that life could exist on any of them.

During the 1960's, the United States and the Soviet Union sent missions to Venus. These missions revealed that environmental conditions on the surface of Venus could not support life as we know it. However, some scientists believe that organisms could exist in the clouds that surround Venus.

In 1976, two United States space probes, Viking 1 and

Viking 2, landed on Mars and performed several experiments to test for life. These experiments indicated chemical activity in Martian soil, but failed to detect any living organisms. In 1996, scientists claimed they found evidence of Martian life from a meteorite discovered in Antarctica. This meteorite, over 3.6 billion years old, contained objects resembling fossils of bacteria. It also contained compounds that are produced by living organisms on the earth. The question of life remains unsettled, but most scientists consider it very unlikely.

Exobiologists think that many stars beyond our solar system may have planets on which life could exist. However, enormous distances separate the earth from the stars. With our present technology, it is difficult even to detect the presence of other planets, much less to search for life on them. We can therefore learn of life on distant planets only if they are inhabited by intelligent beings capable of communicating across the vast reaches of space. Some scientists have begun using radio telescopes to listen for communication signals from distant civilizations. Harold J. Morowitz

Related articles in *World Book* include:

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Life expectancy
Mars (Possibility of life)
Metabolism
Natural selection
Nitrogen cycle
Oparin, Alexander I.
Pasteur, Louis
Protoplasm
Reproduction
Reproduction, Human
Spontaneous generation
Zoology

Outline

I. The characteristics of living things
A. Reproduction
B. Growth
C. Metabolism
D. Movement
E. Responsiveness
F. Adaptation
II. Living things and their environment
A. The physical environment
B. The biological environment
III. The structure of living things
A. Cells
B. Tissues, organs, and organ systems
IV. The chemical basis of life
A. Carbohydrates
B. Lipids
C. Proteins
D. Nucleic acids
V. The origin of life
A. Religious explanations
B. The theory of spontaneous generation
C. Modern theories
VI. The search for life on other planets

Questions

What are some basic characteristics of living things?
What features make up an organism's physical environment?
How do cells of bacteria differ from all other cells?
What is the chief source of biological energy?
What experimental evidence do scientists have to support the theory of chemical evolution?
How many species of living things exist on the earth?
What are the two main ways in which living things adapt to changes in the environment?
Why is water essential to life processes?
What is *exobiology*?
In what ways do organisms use carbohydrates?

Additional resources

Level I

Fullick, Ann. *The Living World.* Heinemann Lib., 1999.
Living World. Oxford, 1993.
Snedden, Robert. *Life.* Chelsea Hse., 1995.

Level II

Fortey, Richard. *Life.* Knopf, 1998.
Hoagland, Mahlon B., and Dodson, Bert. *The Way Life Works.* 1995. Reprint. Times Bks., 1998.
Margulis, Lynn, and Sagan, Dorion. *What Is Life?* 1995. Reprint. Univ. of Calif. Pr., 2000.

Life cycle is the sequence of changes that a living thing passes through from a particular form in one generation to the development of the same form in another generation. Growth and reproduction always take place. The life cycle of mammals is relatively simple. Mammals develop from a fertilized egg to an adult by growth. The adults produce *gametes* (sex cells). Fertilization of the egg in mammals begins development of a new individual.

Many lower organisms have even simpler life cycles. But most plants and some animals go through complex life cycles, involving more than one kind of individual. In many, a generation of sexual reproduction follows one of asexual reproduction. The sequence of changes through which an organism passes during its lifetime is called its *life history.* Lawrence C. Wit

Related articles in *World Book* include:

Alternation of generations
Generation
Life
Metamorphosis
Reproduction

Life expectancy is a statistical measure of the average number of years that a group of people of a certain age may expect to live. This measure is based on the death rates by age for a specific population at a specific time. It assumes that the death rates will not change in the future. If death rates decline, as has normally happened, life expectancy increases. Social scientists and health workers use life expectancy to summarize the effects of death rates on a population.

The table on the next page compares the life expectancies at birth for the male and female populations of various countries. Life expectancy varies from country to country because of differences in public health and standards of living. In general, the industrialized nations have the highest life expectancy, and the developing countries, especially those in Africa, have the lowest. With very few exceptions, females have a higher life expectancy than males.

Since 1900, three major changes have taken place in life expectancy in the United States. First, the average life expectancy at birth has increased by nearly 30 years—from 47.3 years in 1900 to 76.7 years in 1998. Second, the gap in life expectancy between the sexes has widened. In 1900, newborn girls could be expected to live two years longer than newborn boys. In 1998, girls could be expected to live almost six years longer. Third, the difference in life expectancy between white Americans and Americans of other races has decreased. In 1900, whites could be expected to live 14.6 years longer than other Americans. In 1995, this difference was 4.6 years.

Jeanne Clare Ridley

Life insurance. See Insurance (Life insurance).

Life expectancy at birth for selected countries

Country	Male	Female
Africa		
Algeria	68	70
Angola	45	48
Benin	49	51
Botswana	43	45
Burkina Faso	47	47
Burundi	46	47
Cameroon	55	56
Central African Republic	43	46
Chad	46	51
Congo (Brazzaville)	45	50
Congo (Kinshasa)	47	50
Côte d'Ivoire	45	48
Egypt	64	67
Eritrea	52	57
Ethiopia	45	47
Gabon	51	54
Gambia	43	47
Ghana	56	59
Guinea	43	47
Guinea-Bissau	47	44
Kenya	48	49
Lesotho	52	55
Liberia	49	52
Libya	73	77
Madagascar	51	53
Malawi	38	40
Mali	55	52
Mauritania	52	55
Mauritius	67	74
Morocco	67	71
Mozambique	40	39
Namibia	47	45
Niger	41	41
Nigeria	52	53
Rwanda	39	40
Senegal	51	54
Sierra Leone	42	47
Somalia	45	48
South Africa	54	57
Sudan	50	52
Tanzania	52	54
Togo	48	50
Tunisia	67	70
Uganda	42	43
Zambia	37	38
Zimbabwe	41	39
Asia		
Afghanistan	46	45
Armenia	71	78
Azerbaijan	68	75
Bangladesh	59	58
Cambodia	54	58
China	69	73
Georgia	69	76
India	60	61
Indonesia	62	66
Iran	68	71
Iraq	58	60
Israel	76	80
Japan	77	84
Jordan	68	70
Kazakhstan	59	70
Korea, North	67	73
Korea, South	71	78
Kuwait	72	73
Laos	50	52
Malaysia	70	75
Myanmar	53	56
Nepal	58	57
Pakistan	58	59
Philippines	66	69
Saudi Arabia	68	71
Singapore	76	80
Sri Lanka	70	74
Syria	67	68
Tajikistan	66	71
Thailand	70	75
Turkey	67	71
Turkmenistan	62	69
Uzbekistan	66	72
Vietnam	63	69
Yemen	58	61
Australia and Pacific Islands		
Australia	76	82
New Zealand	74	80
Papua New Guinea	56	57
Europe		
Albania	69	74
Austria	75	81
Belarus	63	74
Belgium	75	81
Bosnia-Herzegovina	71	76
Bulgaria	67	74
Croatia	69	76
Czech Republic	71	78
Denmark	74	79
Estonia	64	75
Finland	74	81
France	75	82
Germany	74	80
Greece	75	81
Hungary	66	75
Ireland	73	79
Italy	75	81
Latvia	64	76
Lithuania	67	77
Macedonia	70	75
Moldova	63	70
Netherlands	75	81
Norway	76	81
Poland	69	78
Portugal	72	79
Romania	66	73
Russia	61	73
Slovakia	69	77
Slovenia	71	79
Spain	74	82
Sweden	77	82
Switzerland	77	83
Ukraine	63	74
United Kingdom	74	80
North America		
Canada	76	81
Costa Rica	75	79
Cuba	73	78
Dominican Republic	67	71
El Salvador	67	73
Guatemala	61	67
Haiti	47	51
Honduras	66	71
Jamaica	70	73
Mexico	69	75
Nicaragua	66	71
Panama	72	77
Trinidad and Tobago	68	73
United States	74	79
South America		
Argentina	70	77
Bolivia	59	62
Brazil	64	71
Chile	72	78
Colombia	65	73
Ecuador	67	72
Paraguay	68	72
Peru	66	71
Uruguay	70	78
Venezuela	70	76

Figures are for 2000.
Source: Population Reference Bureau.

Life jacket is a device that is worn to keep afloat in water. Most life jackets are filled with light material, such as kapok, plastic foam, fiberglass, cork, or balsa wood. They are often brightly colored to make them easily visible. Most have no sleeves, so the wearer's arms can move freely. Some life jackets are also called *life preservers* or *life vests.*

Life jackets belong to a group of water-safety devices called *personal flotation devices* (PFD's). Other PFD's include *buoyant cushions* (floating pillows) and doughnut-shaped *ring buoys.* These devices can be thrown to a person in the water from a boat or from land. The person holds onto the cushion or buoy to keep afloat. The U.S. Coast Guard classifies PFD's by their use in different water conditions. Patience Wales

Life preserver. See Life jacket.

Lifesaving. See **Swimming** (Water safety); **Drowning; Coast Guard, United States** (Safety); **First aid.**

Lift is the term used in the United Kingdom and other Commonwealth countries for an elevator. See **Elevator.**

Ligament is fibrous tissue that holds organs of the body in place and fastens bones together. Ligaments are grouped together in cords, bands, or sheets. They are as strong as rope.

A *sprain* occurs when ligaments covering a joint are torn or twisted. A sprained ankle is the partial tearing of the ligaments that bind the bones of the lower leg to the bones of the foot. Ligaments heal slowly. They may never heal if they are completely torn apart. Treatment of sprained ligaments may include exercise, supportive bandages or splints, or even surgery, depending on the ligaments involved and the severity of the injury.

Bruce Reider

See also **Sprain; Human body** (picture: Ligaments and tendons).

Ligature is a thread that is used in surgery to tie a bleeding blood vessel. Surgeons did not use ligatures extensively until germfree surgery developed during the mid-1800's. Before that time, ligatures almost always caused infection. British surgeon Joseph Lister devised a sterile ligature, called *catgut,* from a sheep's bowel. The body absorbs this material without harm. Surgeons also use silk, cotton, linen, and nylon ligatures. These are not absorbed but are not harmful. Arnold Gerald Coran

Light



© Ron Thomas, FPG

Light from the sun makes life on the earth possible. Plants need sunlight to grow, and animals eat plants or plant-eating animals.

Light is so common that we often take it for granted. Yet the world would quickly change if suddenly there were no light. We could no longer see, because light that comes to our eyes makes seeing possible. Without light, we would have no food to eat or air to breathe. Green plants use the light from the sun to grow and to make food. All the food we eat comes from plants or animals that eat plants. As plants grow, they give off oxygen. This oxygen is a necessary part of the air we breathe.

Light gives us fuels. The energy in the sunlight that shone on the earth millions of years ago was stored by plants. After these plants died, they were changed into coal, natural gas, and oil. Today, we use the energy in these fuels to produce electricity and to operate machines.

Light from the sun also heats the earth. Without the sun's light, the earth would soon become so cold that nothing could live on it. Even if we burned all our fuels, we could not keep the earth warm enough for life to exist. For more information on light and energy from the sun, see the *World Book* articles on **Solar energy** and **Sun**.

People have found ways of making and controlling light in order to see when there is no sunlight. At first, they produced light with campfires and torches. Later, they developed candles, oil lamps, gaslights, and electric lights.

People make and use light for many other purposes than to see by. For example, the pictures on a television screen consist of spots of light. Using scientific instruments, people can study light itself and learn much about the universe. For example, the light from distant stars can tell scientists what the stars are made of. It can also tell them if the stars are moving toward or away from the earth and how fast they are moving. See **Redshift**.

What is light? This question has been a puzzle for centuries. People once thought light was something that traveled from a person's eyes to an object and then back again. If anything blocked the rays from the eyes, the object could not be seen. Since the 1600's, scientists have made many discoveries about light. They have learned that light is a form of energy that can travel freely through space. The energy of light is called *radiant energy.* There are many kinds of radiant energy, including infrared rays, radio waves, ultraviolet rays, and X rays. We can see only a tiny part of all the different kinds of radiant energy. This part is called *visible light* or simply *light.*

This article describes where light comes from, the nature of light, and how light behaves when it comes in contact with various materials. The article also tells how light is measured and discusses the important scientific discoveries about light. By building the Science Project included in this article, you can experiment with the behavior of light. For more information on how people use light for seeing, see **Lighting.**

Jearl Walker, the contributor of this article, is Professor of Physics at Cleveland State University and the author of the monthly column "The Amateur Scientist" in Scientific American *magazine.*

Light makes it possible for us to see. Many of the things we see, such as the sun, a flashlight, and room lights, are *sources* of light. We see all other things because light from a source bounces off them and travels to us. Light sources can be classified as *natural* or *artificial.* Natural light comes from sources that we do not control. Such sources include the sun and the stars. Artificial light comes from sources that we control. These sources include candles and flashlights.

How light is produced. All light comes from atoms. It is produced by atoms that have gained energy either by absorbing light from another source or by being struck by other particles. An atom with such extra energy is said to be *excited.* Ordinarily, an atom stays excited only briefly. It de-excites by giving up its extra energy. It can either run into another atom to lose the energy, or it can *emit* (give off) light. The light then carries away the extra energy. The amount of energy needed to excite atoms and the amount of energy the atoms emit as light varies for different kinds of atoms.

Light is usually described as a wave, shaped much like a water wave that moves across a lake. But light can also be described as a small particle, called a *photon.* Each photon moves in a straight line, much as a pool ball does. In both descriptions, the light has energy. The amount of energy that is carried by the wave or photon largely determines the color of the light. For example, suppose you see a red apple on a blue chair. Each photon from the apple has less energy than a photon from the chair.

One way to excite atoms so that they emit light is by heating them. A poker may be heated until it is white-hot. Because of the heating, the atoms at the poker's surface collide violently with each other. When they collide, they excite one another. Each atom quickly emits its extra energy as light but is almost immediately re-excited by another collision. These collisions produce such a variety of states among the atoms that the photons released have a wide range of energies. The combination of all the resulting colors is white light. As the poker cools, fewer atoms are excited to high energies, and so the atoms emit fewer photons with the higher energies of blue light. Since red light is still being emitted, the cooling poker looks red.

Other sources of light. Many substances gain energy and emit light without being heated very much. They do this through a process called *luminescence.* Some luminescent materials glow in the dark long after they have received extra energy. They are said to be *phosphorescent.* Their atoms stay excited for some time before they de-excite and emit light. Certain phosphorescent materials are used in the markings that glow on watch faces (see **Phosphorescence**). Other luminescent materials emit light only during their exposure to exciting energy. They are said to be *fluorescent* (see **Fluorescence; Fluorescent lamp**).

Fireflies and a few other types of organisms emit light by a process called *bioluminescence.* In this process, chemicals within the organisms combine to produce a different chemical that has excited atoms. When the atoms de-excite, they emit photons.

The sun shines because nuclear reactions between hydrogen atoms within its core produce a tremendous amount of energy. Photons and other kinds of particles carry the energy to the sun's surface. At the surface, these particles excite atoms that then de-excite by emitting light. The earth receives part of that light. All stars emit light by this process.

An *aurora* such as the northern lights is an emission of light by molecules of air. When high-speed particles arrive at the earth from large eruptions on the sun, they crash into the air molecules. These collisions excite the molecules with extra energy. The molecules then release the energy by giving off light. When the collisions occur at night, the light emitted may be bright enough to be seen.

A *laser* is a device that produces a powerful, narrow beam of light in which all the photons have the same energy and travel in the same direction. Lasers serve as tools in scientific research, surgery, and telephone communications. They also have many industrial and military uses.

Natural and artificial sources of light

Natural light sources, such as auroras and fireflies, are not controlled by people. People control artificial light sources, such as candles and lasers. All light comes from atoms.



© Hanson Planetarium from FPG

Aurora



© Ivan Polunin, Bruce Coleman Inc.

Firefly



© FPG

Candle



© Hank Morgan/SS from Photo Researchers

Laser

The nature of light

During most of the 1800's, scientists thought of light as a wave that travels much like a water wave. This idea of light as a wave was popular because it explained experiments in which light created a series of bright and dark lines called an *interference pattern.* Scientists could explain such interference patterns only by describing light as a wave.

If light is a wave, then what waves? Water waves are easier to explain. They travel across the surface of the water while the water itself only moves up and down. To scientists of the 1800's, light seemed stranger than water waves because it travels through space from the sun and other stars to the earth. They assumed that light waves must also travel through some kind of material, just as water waves travel through water. Although scientists had no evidence of this material, they called it the *ether.* By the late 1800's, scientists had concluded that light waves consist of regions of force known as *electric fields* and *magnetic fields.*

A simple model of a light wave begins with a *ray* (a straight line) that shows the direction of the light's travel. Along the ray and *perpendicular* (at right angles) to it, short arrows represent the electric field. Some arrows point upward from the ray and other arrows point downward from it. They vary in length so that the overall pattern of the tips of the arrows looks like a wave. Arrows representing the magnetic field also resemble a wave, but these arrows make right angles to the arrows that represent the electric field. These patterns move along the ray. They are the light.

By the early 1900's, experiments had shown that scientists finally had to give up the idea of an ether. Many scientists realized that a wave of light, as a regularly varying pattern of electric and magnetic fields, can travel through empty space.

Light waves resemble other types of waves in some features, including *wavelength, frequency,* and *amplitude.* The wavelength is the distance along a straight line from one *crest* (peak) of the wave to the next. The frequency of a wave is the number of times each second that crests pass a stationary checkpoint. The amplitude of a wave is the greatest distance of a crest or *trough* (low point) from the ray.

A simple relation exists between a wave's frequency and wavelength: the higher the frequency, the shorter the wavelength. A wave's energy corresponds to its amplitude. The greater the amplitude, the more energy the wave has. The energy of a light wave also corresponds to its frequency. The wavelength determines the color of the light.

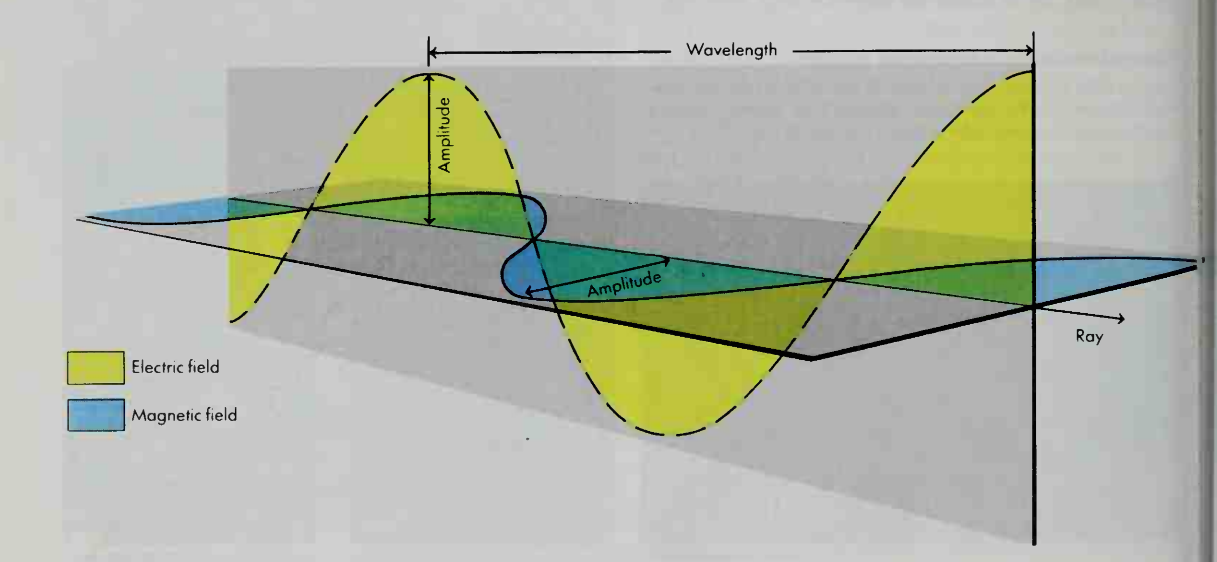
Photons. In 1905, the German-born physicist Albert Einstein proposed a model of light just as useful as the wave model. In some experiments, light behaves as though it is a particle. We now call this type of particle a photon. In Einstein's model, a ray of light is the path taken by a photon. For example, when a flashlight sends a beam of light across a dark room, the beam of light consists of a great many photons, each traveling in a straight line.

Is light a wave or a particle? Seemingly, it cannot be both because the two models are so different. The best answer is that light is strictly neither. In some experiments, light behaves like a wave, and in others, it behaves like a particle.

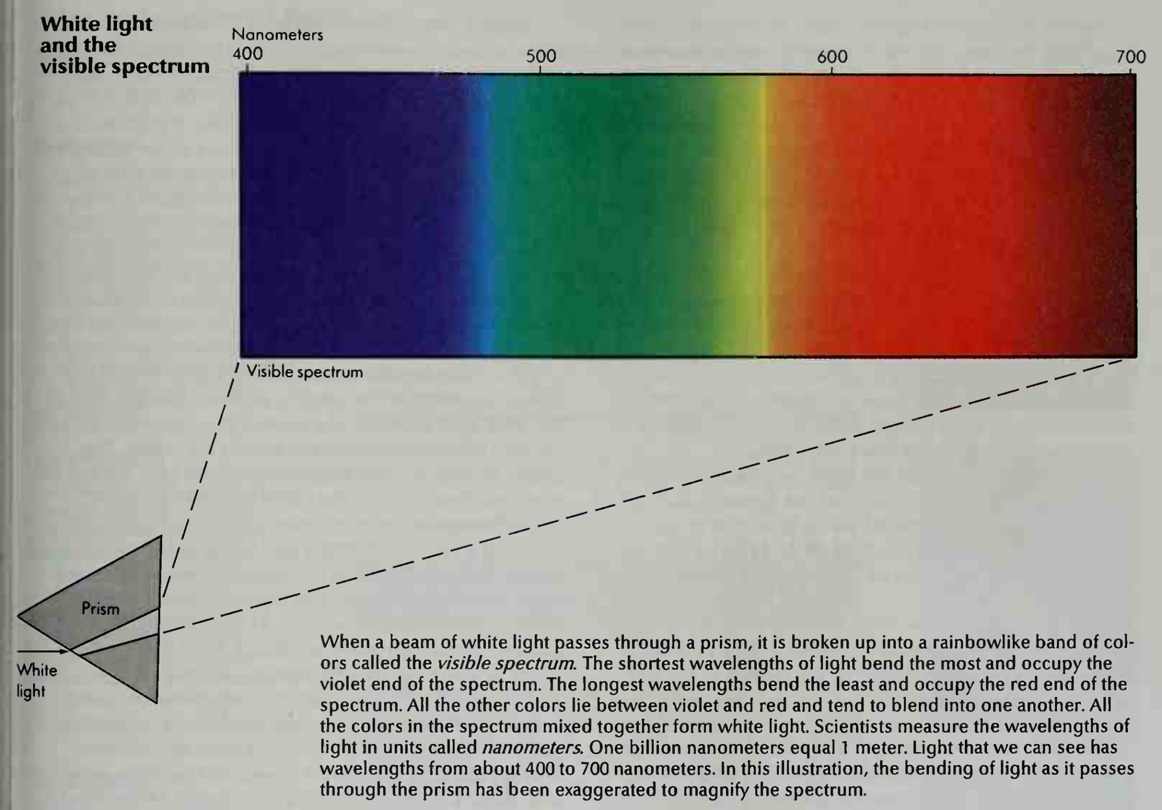
Unlike other kinds of waves, light waves in a vacuum have one speed, and that speed is the fastest that anything can travel. Scientists do not understand why this is true. The fact that light in a vacuum has only one speed forms one of the foundations of Einstein's theory of relativity (see **Relativity** [Special relativity]).

Electromagnetic nature of light

Light is a kind of electromagnetic wave. Such a wave consists of an electric field and a magnetic field. These fields are at right angles to each other and to the direction of the wave's travel. The wave's *amplitude* is its greatest distance from the ray.



White light and the visible spectrum



When a beam of white light passes through a prism, it is broken up into a rainbowlike band of colors called the *visible spectrum.* The shortest wavelengths of light bend the most and occupy the violet end of the spectrum. The longest wavelengths bend the least and occupy the red end of the spectrum. All the other colors lie between violet and red and tend to blend into one another. All the colors in the spectrum mixed together form white light. Scientists measure the wavelengths of light in units called *nanometers.* One billion nanometers equal 1 meter. Light that we can see has wavelengths from about 400 to 700 nanometers. In this illustration, the bending of light as it passes through the prism has been exaggerated to magnify the spectrum.

When light enters a material, it continually runs into atoms that delay its travel. But between atoms, light travels at its normal speed.

Electromagnetic waves. Because light consists of electric and magnetic fields, it is called an *electromagnetic wave.* The term *light* commonly refers to just those electromagnetic waves that we can see. For light to be visible, it must have a wavelength within a certain narrow range of values called the *visible spectrum.* Violet light has the shortest wavelength that is visible. Red light has the longest. Between them lie all the other colors of the spectrum, each with its own wavelength. Seen together at the same time, the colors appear as white light. Sunlight is white because it has all the colors. However, when it passes through a specially shaped transparent solid called a *prism,* the different colors separate and can be seen.

The visible spectrum forms only a small part of the full range of electromagnetic waves. Waves that have wavelengths slightly too short to be seen are called *ultraviolet rays.* They cause suntan, sunburn, and skin cancer. Waves with somewhat shorter wavelengths than ultraviolet rays are called *X rays.* These rays can penetrate a person's body. Doctors and dentists use them to "see" inside the body. *Gamma rays* have even shorter wavelengths than X rays. They result from nuclear reactions, such as those in the sun.

Waves with wavelengths slightly longer than those of red light are called *infrared rays.* When you stand in bright sunlight or in front of a fire, you feel warm largely because of the infrared light shining on you. *Microwaves* and *radio waves* have longer wavelengths than infrared waves. A microwave oven shines microwaves on food to warm it. A police officer's radar unit shines microwaves onto an approaching car to measure its speed. Radio and television stations broadcast programs by sending radio waves.

Sunlight spread into its different colors by a prism creates a *continuous spectrum.* From violet to red, the spectrum blends smoothly from one color to the next. Many other sources of light do not produce a continuous spectrum. For example, a street lamp may produce bright yellow, blue, and a few dimmer colors, but it also has dark regions in its spectrum. The colors are produced by certain atoms in the gas inside the lamp. For example, the yellow comes from sodium atoms. Each type of atom can produce only certain colors.

Scientists can learn what kinds of atoms make up a light source by observing what colors are present in the light. They direct the light through an instrument called a *spectrometer* to separate the colors. The spectrometer may be a simple prism or it may be a more complicated device.

Sometimes a spectrum contains gaps because the light from a source has traveled through a gas that absorbed certain colors. For example, when sunlight is sent through a high-quality spectrometer, its spectrum has thousands of such gaps. The light produced within the sun must travel through the outer atmosphere of the sun to reach the earth. Each type of atom in the sun's atmosphere absorbs certain colors. By noting which colors are removed, scientists are able to determine what kinds of atoms are in the atmosphere of the sun. See **Spectrometer**.

How light behaves

The study of light is called *optics.* By understanding how light behaves, scientists have learned to design a variety of optical instruments that aid in the study of the universe. For example, microscopes enable us to examine extremely small objects, such as single-celled organisms. With telescopes, we can observe distant but very large objects, such as galaxies and planets. Optics also enables us to understand vision, the colors of the sky, the sparkle of a diamond, and many other parts of the everyday world.

Reflection, refraction, and absorption. When a ray of light reaches a surface between two types of materials, such as air and glass, several things can happen. Some of the light may reflect from the surface, while some may pass through the surface. The light that enters the second material may *refract* (change its direction). In addition, some light may be *absorbed* by molecules on the surface or within the second material.

A *transparent* material lets light rays pass through it without mixing them up. You can see through such material. A *translucent* material also allows rays to pass through it, but it mixes them up so that you cannot see clearly through the material. An *opaque* material blocks all light.

The reflection of a ray from a surface resembles the bounce a pool ball takes at the edge of a pool table. Imagine a line perpendicular to the reflecting surface. Such a line is usually called the *normal.* The angle between the path of an incoming ray and the normal is called the *angle of incidence.* The reflected ray makes the same angle to the normal as the incoming ray, but on the other side of the normal. Reflection works this way even when it involves rough surfaces. Wherever a ray reflects from a surface, it has an equal angle to the normal at that spot as it had before the reflection.

When light reflects from a smooth surface, all of its rays reflect in the same direction. When light reflects from a rough surface, the rays reflect in many directions because the normals at all spots on the surface point many ways. Thus, you can see your image in a mirror, but not in a sheet of paper. See **Reflection**.

When light passes through a surface, its speed changes. This happens because the light must travel through a different kind of molecule than it passed through before. For example, if light passes from air into glass, it slows because the glass molecules are more densely packed than the air molecules. If the light enters at any angle except a right angle, the change in the light's speed changes its direction of travel. In other words, the light refracts.

When a ray passes from air into glass, it bends towards the normal at the surface. The amount of bending depends partly on the type of material the ray enters. Different types of glass and plastic refract light by different amounts. Diamond refracts light much more than either glass or plastic does.

To observe refraction, place a pencil in a glass of water and then look at the pencil from the top and one side. The pencil appears bent at the water surface. The light from the top part of the pencil comes directly to your eyes. The rays from the bottom part pass through the surface between the water and the air. There the rays refract, and so they seem to have come from a pencil bottom bent from the pencil top. See **Refraction**.

Opaque materials absorb certain colors of light. For instance, a red book cover exposed to white light looks red because molecules on its surface absorb all the other colors in the light. Transparent materials also absorb certain colors if they contain dyes or pigments.

Scattering describes what happens when light rays strike atoms, molecules, or other individual, tiny particles. These particles send the rays of light off in new directions—that is, they cause the rays to *scatter.* Most of a clear sky appears blue because air molecules scatter more blue rays toward us than they do the other colors in sunlight. When the sun is near the horizon, it looks orange or red because the light reaching us has lost so much of its other colors by scattering.

On a clear day, the ocean appears blue because of two processes: (1) The ocean's surface reflects some of the blue light from the sky toward the observer. (2) Light coming directly from the sun enters the water. The water molecules then scatter more blue rays toward the observer than they do the other colors in sunlight.

Interference. In many cases, light can be thought of as being a wave with crests and troughs. When two light waves cross through the same spot, they *interfere* with each other—that is, they add to or subtract from each other. Suppose that whenever a crest of one wave passes through the spot, so does a crest of the other wave. The two crests add together to give a larger crest. This process, called *constructive interference,* gives brighter light than either wave would have separately. Suppose instead that whenever a crest of one wave crosses through the spot, a trough of the other wave also does. The trough reduces the height of the crest, leaving the spot dim or even dark. This process is called *destructive interference.*

The fact that light can interfere to produce brightness or darkness provides the strongest argument for the wave model of light. In the early 1800's, the English scientist Thomas Young showed the wave nature of light by sending a light beam through two narrow slits. The light that emerged from the slits then reached a screen. If light were not a wave, only two narrow, bright strips of light—one from each slit—would have appeared on the screen. But, in fact, the light emerging from each slit spread and overlapped the light emerging from the other slit.

This light filled the screen with bright and dark lines called *fringes.* Bright fringes occurred where the two waves arrived crest-on-crest to give constructive interference. Dark fringes occurred where the two waves arrived crest-on-trough to give destructive interference. See **Interference**.

Diffraction. In Young's experiment, the light passing through each slit spread. This type of spreading is called *diffraction.* Like interference, it results from the fact that light behaves as a wave. A light wave spreads slightly when it travels through a small opening, around a small object, or past an edge. Water waves also spread, but the openings and objects that cause them to spread must be much larger than those for light.

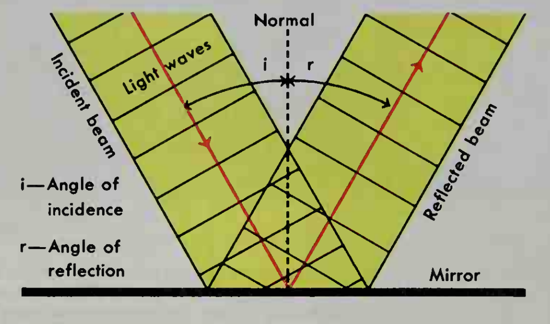
Diffraction of light can be a nuisance. Suppose you attempt to see a very small object by using a high-quality microscope. As you increase the magnifying power to see the object more and more closely, the object's edges begin to blur. Each edge blurs because the light

The behavior of light

In studying *optics* (the science of the behavior of light), physicists have discovered certain principles that describe how light behaves. The most important of these principles include (1) reflection, (2) refraction, (3) diffraction, and (4) interference.

Reflection

A beam of light will be reflected by a smooth surface. The beam coming toward the surface is called the *incident beam.* After the beam has been reflected, it is called the *reflected beam.* The angle the incident beam makes with an imaginary line *normal* (at right angles) to the surface equals the angle made by the reflected beam.

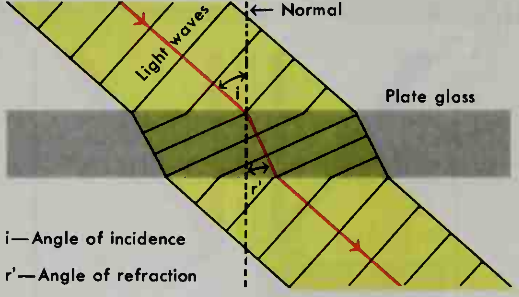




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Refraction

Refraction causes a beam to bend as it passes from one substance into another. The beam bends toward the normal if it slows down when entering a substance, as shown in the diagram. The *angle of refraction* then is less than the *angle of incidence.* If light travels faster in the substance, the beam bends away from the normal.

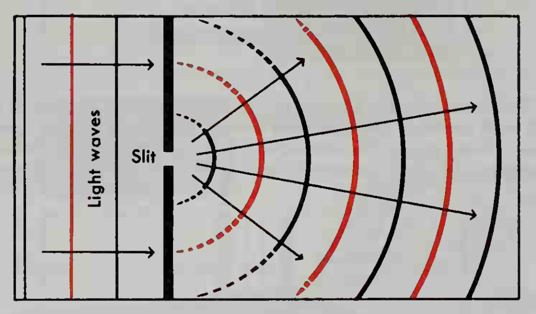




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Diffraction

Light and other waves usually travel in a straight line. But when waves pass through a slit about the same size as their own wavelength, they *diffract* (spread out) into curving waves. The photograph shows water waves because light waves spread out so slightly that their diffraction is difficult to see.

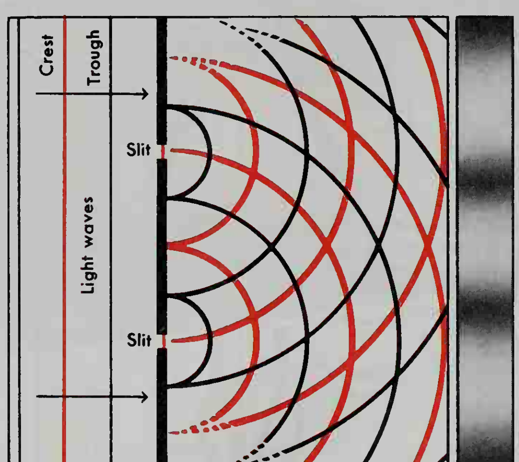




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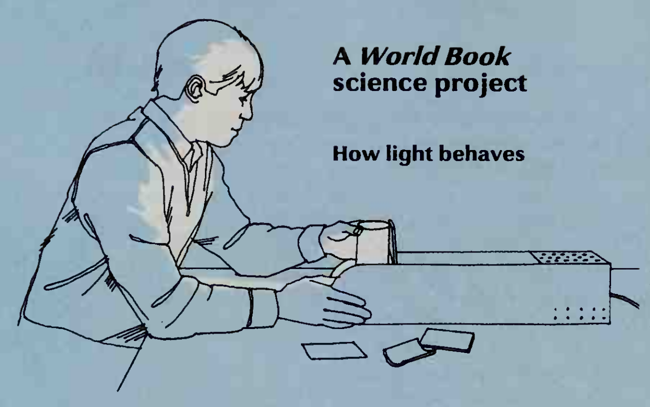
Interference

Light waves can interfere with each other in two ways. (1) Where the *crest* (peak) of one wave meets the crest of another—or where the *trough* (low point) of one wave meets the trough of another—the two waves combine and form a bright spot of light. This process is called *constructive interference.* (2) Where a crest meets a trough, the two waves cancel, leaving a dark spot. This process is called *destructive interference.* The photograph shows the interference pattern of water waves produced by two sources.





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A *World Book* science project

How light behaves

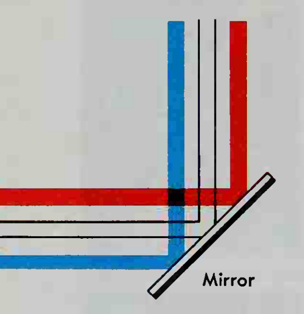
The purpose of this project is to learn about the behavior of light by studying how light rays are reflected and refracted.

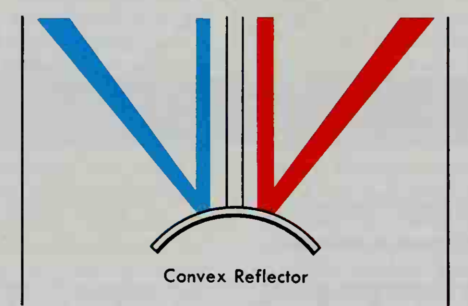
Caution: This project involves working with electricity, which can cause burns, shock, or fire. If you are not familiar with the precautions for working with electricity, you must have a knowledgeable person help you with this project.

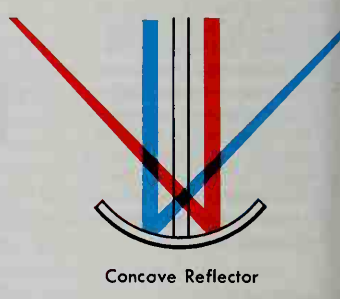
A projector for studying light, *left,* can be built of simple materials sold at local stores. The projector has cellophane filters, which create beams of colored light and so make it easy to trace the paths of the light rays. Put mirrors, glasses of water, and other materials on the viewing platform to see the reflection and refraction of light.

Reflection

You can find out how reflected light behaves by shining the beams of light from the projector on objects of various shapes as shown below. Use mirrors or highly polished pieces of metal as reflectors. Compare all the angles made by the three light beams as they are reflected from each piece. What conclusions can you draw from your observations of the behavior of reflected light?

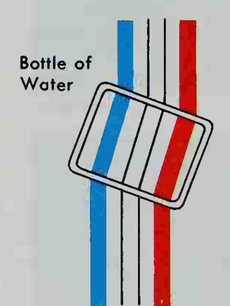


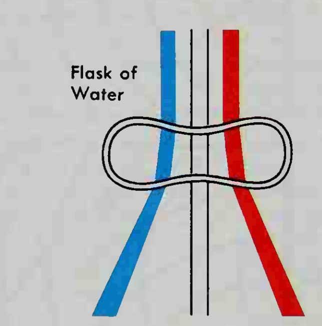


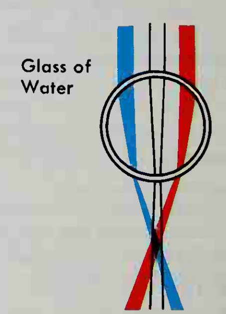


Refraction

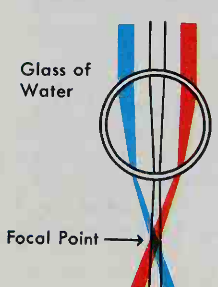
You can show how refracted light behaves when it passes through the same kind of liquid in containers of different shapes. Fill each container with water. Let the light from the projector shine through the container as shown below. Look at the beams of light as they pass through the water and out the opposite side. Note how the beams passing through the water glass cross at a point.

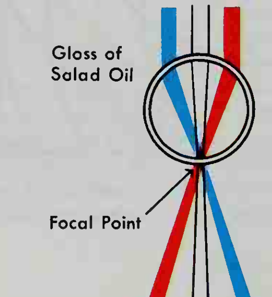


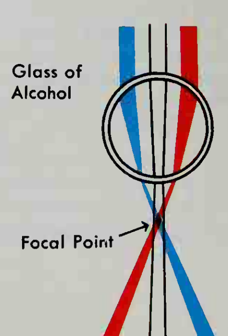




You can show how refracted light behaves when it passes through different kinds of liquids in containers of the same shape. Use three straight-sided glasses of the same size for this demonstration. Fill one glass with water, another with salad oil, and the third with alcohol. Shine the light through each glass. Note the *focal point,* where the three beams of light cross one another.



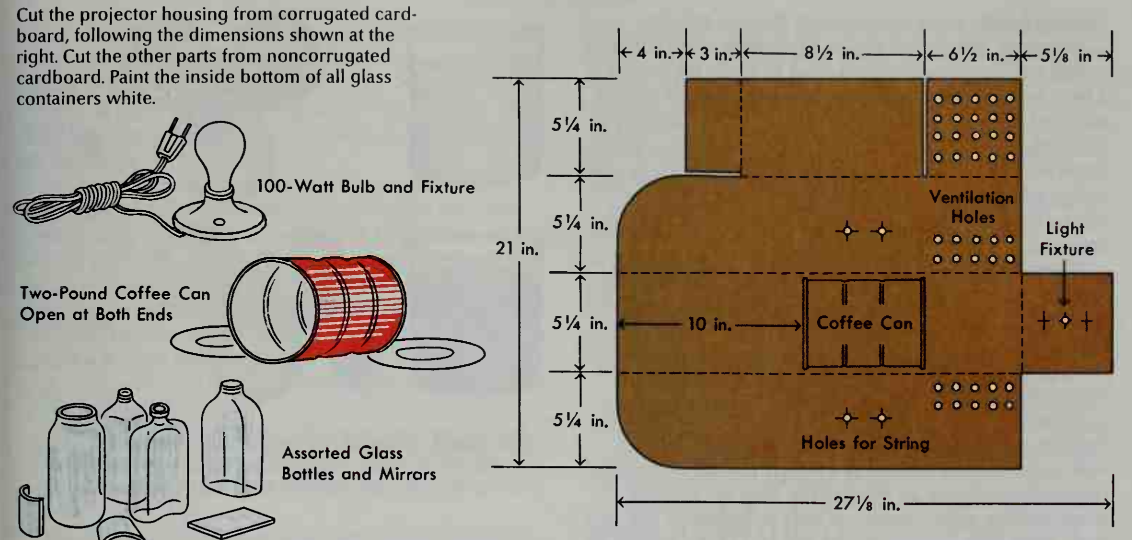






Materials and assembly

Cut the projector housing from corrugated cardboard, following the dimensions shown at the right. Cut the other parts from noncorrugated cardboard. Paint the inside bottom of all glass containers white.



To make the color filters, cut a square of cardboard as shown at the left below and tape it to the front of the assembled projector. Cut a round piece as shown at the right below and tape it to the coffee can. Make three slides of cardboard as shown at the center below. The large pieces are the sides. Fasten the small pieces between the sides at top and bottom to form a narrow channel. On two slides, cover one end of the channel with colored cellophane. Leave the channel open in the third slide.

5⅛ in.
3/16 in.
2 in.
¼ in.
5⅛ in.
1/32 in. thick
4 in.
2 in.
2 in.
4 in.
¼ in.
⅛ in. thick
4 in.
5 in.
3/16 in.
2 in.
¼ in.

Staple Holding Foil
Demonstration Piece
Slides
Coffee Can
100-Watt Bulb and Fixture
Aluminum Foil
String
Elevation Blocks
White Cardboard Platform

To assemble the projector, put the coffee can in place. Staple aluminum foil to the sides behind the can. Insert the light fixture. Slip the slides through the slots in the front of the projector and into the coffee can. Use string to hold the can in place. Place the white cardboard platform on the elevation blocks in front of the slides. The platform holds the demonstration piece. To avoid overheating, turn off the projector when it is not in use. Do not let it run unattended.

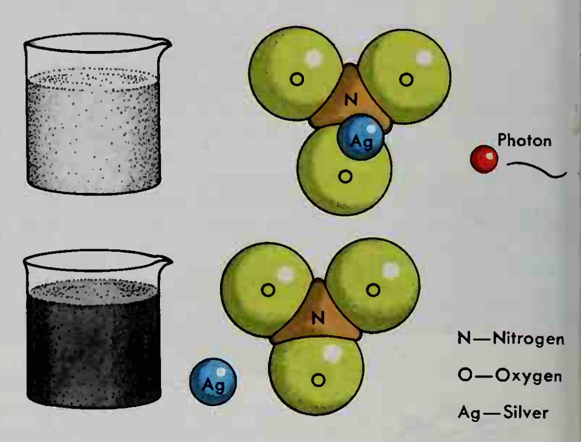
passing by the edge on its way to the eye diffracts.

However, diffraction serves a purpose when a device called a *diffraction grating* is used to study the colors in a light beam. The grating consists of thousands of thin slits that diffract light. Each color in the light diffracts by a slightly different amount. The spread of colors can be large enough to make each color visible. A grating used with a telescope can separate the colors in the light from a star, enabling scientists to learn what materials make up the star. See **Diffraction.**

Dispersion is the spreading of light into its colors. The dispersion of white light separates the colors of the full visible spectrum. One way to disperse a light beam is to send it through a prism. The different colors refract to different extents. Thus, the colors spread. Diffraction and scattering can also disperse light.

Polarization involves the *oscillations* (regular variations in strength) of the electric fields that make up a light wave. The directions of the oscillations may be represented by arrows. In most of the light we see, the arrows point in many directions perpendicular to the ray's path. Such light is *unpolarized.* But few of the arrows remain when light passes through certain types of sunglasses, reflects from surfaces at certain angles, or scatters from air molecules. If these arrows all point in one direction or just opposite it, the light is *polarized.* Suppose that when sunlight reflects from a road to you, its arrows point only to your left or right. You can block it by wearing sunglasses with *polarizing filters.* They block light oscillating left or right. See **Polarized light.**

Chemical effects of light. The energy of light can chemically change the surfaces of materials absorbing it. For example, light chemically changes the molecules of silver grains on photographic film so that an image can be recorded on it. Strong light can fade colored fabrics by chemically changing their dyes. Light changes the chemistry of the eye's *retina,* so that the retina produces signals about sight (see **Eye** [The retina]). Green plants need light for *photosynthesis,* the chemical process by which they make food (see **Photosynthesis**).



Light causes chemical changes in some substances, such as silver nitrate. A photon, *top,* provides the energy needed to break up the molecule and turn the solution dark, *below.*

Photoelectric and photoconductive effects. When certain materials absorb light, the light's energy frees electrons from atoms on the materials' surface. In some devices, these freed electrons can flow through a circuit as electric current. Solar cells and other electric eyes operate by means of such photoelectric effects (see **Electric eye; Photomultiplier tube**). Some materials called *photoconductors* become better conductors of electricity when light shines on them.

Photoelectric effect of light

The energy of light photons creates electric current in a solar cell. A photon releases an electron from an atom in the P-type layer. The electron is driven across the P-N junction into the N-type layer. The electron flows out of the cell, through a load, and back to the P-type layer.

Scientists measure wavelengths of light in a variety of metric units. One common unit is the *nanometer,* which equals a billionth of a meter, or $\frac{1}{25,000,000}$ inch. The wavelengths of light in the visible spectrum range from about 400 nanometers for deep violet to about 700 nanometers for deep red.

The frequency of any wave equals the ratio of the wave's speed to its wavelength. Frequencies are measured in units called *hertz.* A wave has a frequency of one hertz if one crest passes a checkpoint each second, and the wave has a frequency of 100 hertz if 100 crests pass a checkpoint each second. Light travels in a vacuum at nearly 300 million meters per second. Because visible light has a short wavelength and a high speed, it has a high frequency. For example, violet light has a frequency of 750 trillion hertz.

The brightness of light. Scientists use various units to measure the brightness of a light source and the amount of energy in a beam of light coming from that source.

The amount of light produced by any light source is called the *luminous intensity* of that source. The standard unit used to measure luminous intensity is the *candela.* For many years, the luminous intensity produced by a certain size candle made from the oil of sperm whales served as the standard. The unit was called a *candle.* However, the sperm whale candle did not provide an easily used standard for the measurement of light. One candela is now defined as the amount of light given off by a source emitting at a specific frequency (540,000,000,000,000 hertz) and at a specific intensity ($\frac{1}{683}$ watt per unit of area called a *steradian*).

The intensity of a light source in candelas does not indicate how bright the light will be when it reaches the surface of an object, such as a book or a desk. Before we can measure *illumination* (the light falling on a surface), we must measure the light traveling through the space between the source and the object. We can measure a beam of light with a unit called the *lumen.* To see how the lumen is measured, imagine a light source placed at the center of a hollow sphere. On the inside surface of the sphere, an area is marked off equal to the square of the radius of the sphere. For example, if the radius is 1 foot, the area marked off is 1 square foot. If the light source has a luminous intensity of 1 candela, the marked area will receive a *luminous flux* (rate of light falling on it) of 1 lumen.

In the customary system of measurement, engineers measure illumination in units called *foot-candles.* An illumination of 1 foot-candle is produced by 1 lumen of light shining on an area of 1 square foot. The metric system uses a unit called the *lux.* An illumination of 1 lux is produced by 1 lumen of light shining on an area of 1 square meter. See **Foot-candle**.

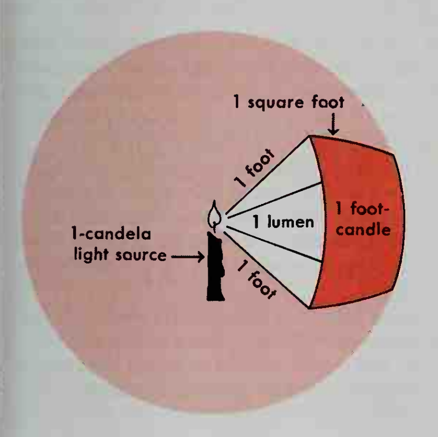
The intensity of light falling on a surface varies *inversely* (oppositely) with the square of the distance between the source and the surface. That is, if the distance increases, the illumination decreases by the square of the distance. This relationship is called the *inverse square law.* If a surface that receives 1 lux of light at a distance of 1 meter from a source is moved 2 meters from the source, that surface will then receive $(\frac{1}{2})^2$, or $\frac{1}{4}$, lux of light. This happens because light spreads out from its source.

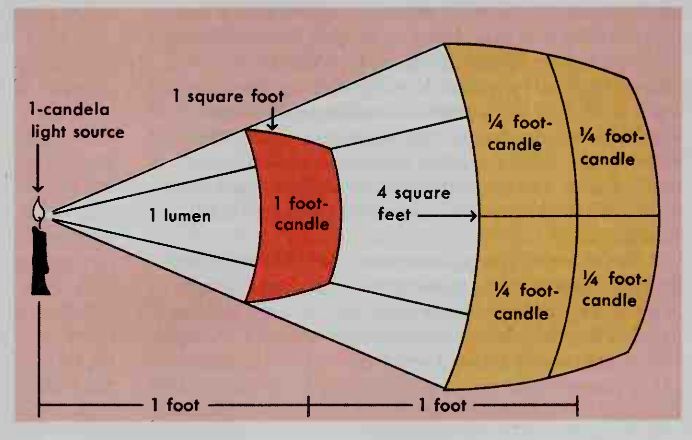
The speed of light. Although light seems to travel across a room the instant a window shade is raised, it actually takes some time to travel any distance. The speed of light in empty space—where atoms do not delay its travel—is 186,282 miles (299,792 kilometers) per second. This speed is said to be *invariant* because it does not depend on the motion of the light's source. For example, light that is emitted by a rapidly moving flashlight has the same speed as light that is emitted by a stationary flashlight. Scientists do not know why this is true, but the fact is one of the foundations of Einstein's theory of relativity.

From ancient times, people argued about whether the speed of light is limited or infinite. During the early 1600's, the Italian physicist Galileo devised an experiment to measure the speed of light, and so settle the ar-

Basic units of light measurement

A *1-candela* light source, *left,* inside a 1-foot-radius sphere illuminates every square foot of the sphere's surface with 1 *lumen* of light. One lumen falling on a 1-square-foot area, *right,* illuminates it with 1 *foot-candle.* Because light spreads as it travels, a surface 2 feet from the light source receives 1 lumen of light spread over 4 square feet, or $\frac{1}{4}$ foot-candle per square foot.





gument. Galileo sent an assistant to a distant hill with instructions that the assistant should open the shutter of a lantern when he saw Galileo on another hill open the shutter of his lantern. Galileo reasoned that because he knew the distance between the hills, he could find the velocity of light by measuring the time between opening his shutter and seeing the light of the second lantern. Galileo's thinking was sound, but the experiment failed. The velocity of light is so great that he could not measure the short time involved.

About 1675, the Danish astronomer Olaus Roemer came upon evidence which proved that light travels at a *finite* (limited) speed. While working in Paris, Roemer observed that the intervals between the disappearance of some of Jupiter's moons behind the planet varied with the changing distance between Jupiter and Earth. Roemer realized that the finite velocity of light caused these differing intervals. Roemer's observations indicated that light traveled at a speed of 226,000 kilometers per second. This figure was within 25 per cent of the actual velocity.

In 1926, the American physicist Albert A. Michelson made one of the first precise measurements of the velocity of light. He used a rapidly rotating mirror that reflected a beam of light to a distant reflector. The returning beam was then reflected back to the observer by the rotating mirror. Michelson adjusted the speed of the mirror until the mirror turned to the correct angle during the time the light traveled to the reflector and back. The speed of the mirror indicated the velocity of the light. Michelson actually used several mirrors on a drum so that the angle the drum had to turn while the light traveled out and back was small. He measured the speed of light at 299,796 kilometers per second. This measurement had a probable error of less than 4 kilometers per second.

Our understanding of light

Early ideas about light. The understanding of light has developed mainly since the 1600's. In 1666, the English scientist Sir Isaac Newton discovered that white light is made up of all colors. Using a prism, he found that each color in a beam of white light could be separated. Newton proposed the theory that light consists of tiny particles that travel in straight lines through space. He called these particles *corpuscles,* and his theory became known as the *corpuscular theory.*

About the same time that Newton proposed his theory of light, the Dutch physicist and astronomer Christiaan Huygens suggested that light consists of waves. He proposed the *wave theory* to explain the behavior of light. The corpuscular and wave theories appear to be completely opposite, and scientists argued about them for about 100 years. Then, in the early 1800's, the English physicist Thomas Young demonstrated the interference of light. He showed that two light beams cancel each other under certain conditions. Water waves also behave this way. Because it is hard to understand how interference could occur with particles, most scientists accepted Young's experiment as proof of the wave theory of light.

The electromagnetic theory. In 1864, the British physicist James Clerk Maxwell proposed the mathematical theory of electromagnetism. According to this theory, the influence that changing electric fields and magnetic fields have on one another allows for the travel of waves. Maxwell's theoretical waves had the exact mathematical properties that had been measured for light. The vibrating electric charges that produce light are the electric charges in the atom. Atomic physicists had already shown that these vibrating electric charges exist. Maxwell's work gave the wave theory of light a solid foundation.

Maxwell's electromagnetic theory also did away with an idea that had stood in the way of scientists' acceptance of the wave theory for more than a century. Scientists felt they had to find the *medium* (material) through which light waves travel. They reasoned that if light travels as waves, there must be something for them to travel through, just as sound waves need air to travel through. But for light, this something could not be matter, because light can travel in a vacuum. To get around this difficulty, scientists suggested that the medium light traveled through was the ether.

All attempts to observe or measure the properties of the ether failed. Scientists became increasingly convinced that the ether did not exist. Experiments conducted by Albert Michelson and the American physicist Edward Morley in 1887 helped destroy the ether theory.

Quantum mechanics. In 1900, the German physicist Max Planck discovered an equation that matched experimental data about the emission of light by a hot surface. Planck could not explain why the equation worked. But he realized that it predicted that the tiny emitters of light on the surface can have only certain values of energy. When energy is restricted to certain values, it is said to be *quantized.*

In 1905, Einstein revealed that light itself is quantized. Einstein reasoned that if light emitters can have only certain values of energy, then the energy they emit as light will retain its quantized character. The light comes in tiny packets of energy that are known as *quanta.* The concept of light as quantized energy explained how light behaves as a particle in certain experiments, instead of as a wave. These particles of light came to be called photons.

In 1913, the Danish physicist Niels Bohr proposed that the energy of atoms was also quantized. When energy is given to an atom, either by a collision or by shining light on it, the atom can accept only certain values of energy. In this way, the atom becomes excited. When it de-excites, it must get rid of the extra energy. One way it can do this is by emitting a photon that carries the energy away. Each type of atom accepts a different set of energies. Thus, when atoms emit light, the photons from one type of atom differ in energy from the photons from other types of atoms.

A field of physics known as *quantum mechanics* is the study of how atoms and light are quantized. It involves the fact that light and matter behave as waves in some experiments and as particles in other experiments.

Jearl Walker

Study aids

Related articles in *World Book* include:

Biographies

Einstein, Albert (Famous theories)
Foucault, Jean B. L.
Huygens, Christiaan
Maxwell, James Clerk
Michelson, Albert A.
Newton, Sir Isaac
Planck, Max K. E. L.
Raman, Sir Chandrasekhara V.

Other related articles

Aberration
Angstrom
Aurora
Bioluminescence
Candela
Color
Diffraction
Electric eye
Electric light
Electromagnetic waves
Ether (physics)
Fiber optics
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Foot-candle
Infrared rays
Interference
Laser
Lens
Light meter
Lighting
Luminescence
Microscope
Mirage
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Penumbra
Phosphorescence
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Photosynthesis
Polarized light
Quantum mechanics
Rainbow
Reflection
Refraction
Relativity
Shadow
Spectrometer
Spectrum
Sun
Telescope
Ultraviolet rays
Waves
Zeeman effect

Outline

I. Sources of light
  A. How light is produced
  B. Other sources of light
II. The nature of light
  A. Photons
  B. Electromagnetic waves
III. How light behaves
  A. Reflection, refraction, and absorption
  B. Scattering
  C. Interference
  D. Diffraction
  E. Dispersion
  F. Polarization
  G. Chemical effects of light
  H. Photoelectric and photoconductive effects
IV. Measuring light
  A. The brightness of light
  B. The speed of light
V. Our understanding of light
  A. Early ideas about light
  B. The electromagnetic theory
  C. Quantum mechanics

Questions

What color is the light with the longest wavelength that is visible?
What are *photons?*
Why is light strictly neither a wave nor a particle?
What property of a light source is measured in unites called *lumens?*
What is *diffraction? Interference? Polarization?*
How does the heating of atoms cause them to give off light?
Why did scientists suggest that light traveled through a medium called the *ether?*
What is the *visible spectrum?*
Why does a pencil in a glass of water appear bent at the water surface?
What theory did the British physicist James Clerk Maxwell propose that strengthened the wave theory of light?

Additional resources

Level I
Burnie, David. *Light.* Dorling Kindersley, 1992.
Day, Trevor. *Light.* Raintree Steck-Vaughn, 1998.

Level II
Lynch, David K., and Livingston, William. *Color and Light in Nature.* Cambridge, 1995.
Park, David A. *The Fire Within the Eye: A Historical Essay on the Nature and Meaning of Light.* Princeton, 1997.
Perkowitz, Sidney. *Empire of Light.* Henry Holt, 1996.
Weiss, Richard J. *A Brief History of Light and Those That Lit the Way.* World Scientific, 1996.

Light, Electric. See Electric light.

Light, Invisible. See Ultraviolet rays.

Light lists. See Lighthouse (Identifying lighthouses).

Light bulb. See Electric light; Edison, Thomas.

Light meter is an instrument used to measure the brightness of light. Light meters serve a variety of specialized needs. Astronomers use them to measure the brightness of stars. Lighting engineers use them to measure the brightness of lighting in homes and offices. Photographers use light meters to measure the intensity of the light in scenes they wish to photograph.

Most light meters include a photo cell made of cadmium sulfide or gallium arsenide. The cell, which is attached to a battery, resists the flow of electric current from the battery by an amount that depends on the brightness of the light. The current is measured by a current meter. When brighter light falls on the cell, the resistance decreases. More current therefore flows, producing a larger reading on the current meter.

A less sensitive type of light meter uses a cell of selenium. When light shines on it, the cell produces a small voltage, which is measured by a voltage meter. The voltage increases with the brightness of the light.

The brightness of light can be expressed in terms of foot-candles, lumens, luxes, or other units. Many photographers' meters measure brightness in arbitrary units chosen by the meter's manufacturer. The units correspond to exposure settings that are on a photographer's camera.

Many cameras feature built-in light meters. Such light meters measure the amount of light entering the camera lens from a narrow range of angles in front of the camera. When the camera points toward an object that reflects light well, the meter registers bright light and so indicates the need for a short exposure. If the rest of the scene is dim, however, the picture may be badly exposed. For this reason, most professional photographers use a separate light meter that can be directed at the source of light. Such meters are better indicators of the appropriate exposure because they measure the light that illuminates the scene rather than measure the light reflected by individual objects. Jearl Walker

See also **Candela; Foot-candle; Lighting; Photography** (Exposure meters).

Light switch. See Electric switch.

Light-year is a unit used by astronomers to describe the distance to and between stars. It is the distance traveled in one year by a pulse of light. Light travels at 186,282 miles (299,792 kilometers) per second. One light-year therefore equals about 5.88 trillion miles (9.46 trillion kilometers). A jetliner traveling at a speed of 500 miles (800 kilometers) per hour would need to fly for 1.34 million years in order to travel one light-year. Astronomical distances are so great that even the star nearest to the earth—other than the sun—is 4.3 light-years away.
C. R. O'Dell

See also **Astronomy** (Units of distance).



United States Lighthouse Society

Drum Point Lighthouse sits on a multilegged platform at the Calvert Marine Museum, Solomons, Md. Its beacon beams alternate flashes of white and red light.

Lighthouse is a tower with an extremely strong light that serves as a navigational aid for mariners. Lighthouses help sailors determine their position, inform them that land is near, and warn them of dangerous rocks and reefs. Lighthouses are built at ports and harbors, on capes and peninsulas, and on isolated rocks. Some are built in the sea itself, with their foundations sunk into rock or coral beneath the water.

Lighthouses have been used as navigational aids for thousands of years. Since the 1940's, however, they have declined in importance because of the development and increased use of advanced electronic navigational aids (see **Navigation** [Electronic navigation]). As a result, the number of lighthouses operated in the United States has declined from about 1,500 in the early 1900's to about 340 today. In fact, there are only about 1,400 lighthouses currently in use worldwide.

The U.S. Coast Guard administers lighthouses in the United States. Canada's approximately 275 lighthouses are maintained by the Department of Transport.

Identifying lighthouses. Every lighthouse gives off a distinctive light pattern known as its *characteristic.* There are five basic types of lighthouse signals: (1) fixed, (2) flashing, (3) occulting, (4) group flashing, and (5) group occulting. A fixed light is a steady beam. A flashing light has periods of darkness longer than periods of light. An occulting light's periods of light are longer than its periods of darkness. A group flashing light gives off two or more flashes at regular intervals, and a group occulting light consists of a fixed light with two or more periods of darkness at regular intervals. There are several variations of these basic patterns. For example, flashes of white light may alternate with flashes of red.

The characteristics and locations of lighthouses are recorded in publications called *light lists.* Mariners determine which lighthouse they are seeing—and therefore their location—by observing the characteristic of a lighthouse and consulting a light list.

In the daytime, lighthouses can be identified by their structure. Most lighthouses are simple towers made of stone, brick, wood, or steel. Some are metal skeletal towers, and others consist of houselike structures atop a multilegged platform. In areas where they are of similar construction, lighthouses are distinguished by their *day marker* pattern—a design of checks and stripes painted in vivid colors on lighthouse walls.

How lighthouses work. Lighthouses project their light through special lenses that increase the intensity of the light from their lamps. Many lighthouses are equipped with a *Fresnel,* or *classical, lens,* which is a huge compound lens that encircles the lamp. Each face of a Fresnel lens is surrounded by a ring of triangular prisms, which reflect and strengthen the light. Such a lens may project light more than 20 miles (32 kilometers). Some Fresnel lenses measure as much as 8 feet (2.4 meters) in height and 6 feet (1.8 meters) in diameter.

A Fresnel lens produces alternating intervals of light and darkness by flashing automatically. A flashing effect can also be produced by arranging the prisms of part of the lens so they prevent light from escaping, and then revolving the lens around the lamp. A series of flashes of different colors is obtained by covering sides of the lens with colored glass.

Some lighthouses produce their light through the use of *sealed-beam lamps,* which swing a beam across the horizon like a searchlight. The filament, reflector, and lens of such lamps are combined in a single unit. The number of times the light can be seen in a certain period depends on how fast the lamp is rotated.

The distance a lighthouse's signal can be seen depends on a number of factors, including the beam's



R. L. Goddard, Berg & Associates

West Quoddy Lighthouse in Lubec, Me., is noted for its stripes. This pattern serves as a *day marker,* enabling mariners to distinguish the lighthouse from others during the day.

strength and the height of the light. Haze, smoke, and bad weather—such as fog, rain, and snow—also affect visibility. As a result, many lighthouses have foghorns, bells, or other sound-making devices that are used to signal vessels under such conditions. Many lighthouses also are equipped with *radio beacons* that send out radio signals, which can be picked up by shipboard radio direction finders.

History. The ancient Egyptians were probably the first people to use light to guide ships. They kindled fires on top of hills at night and later built lighthouses that also used fire as the light source. During the reign of Ptolemy II (283-246 B.C.), the Egyptians completed the Pharos of Alexandria, the tallest lighthouse ever constructed. The structure stood over 400 feet (122 meters) high. It guided ships for about 1,500 years.

The Romans built lighthouses at a number of ports. About A.D. 43, for example, they constructed light towers on both sides of the English Channel, at Dover in Britain, and at Boulogne-sur-Mer in Gaul (now in France). The light beam for these towers was probably produced by a system of multiple flames and mirrors.

The first lighthouse built on a wave-swept rock was Eddystone Rock Light, southwest of Plymouth, England. This lighthouse had a base of huge blocks of stones. Completed in 1698, it was destroyed by a storm in 1703. Since then, three other lighthouses have occupied the site.

The first lighthouse in America was Boston Lighthouse, on Little Brewster Island in Boston Harbor. It was first lit in 1716. The British destroyed Boston Lighthouse in 1776, during the Revolutionary War in America. But another one was built on the site in 1783 and still stands. Sperm-whale oil, kerosene, and lard oil provided fuel for early American lighthouses.

In 1789, the U.S. government established the Federal Lighthouse Service to administer the nation's lighthouses. Lighthouses were operated by lighthouse keepers who lived with their families in or near the lighthouse. The lighthouse keeper's duties included lighting the wick, polishing the reflecting mirrors, and cleaning soot off the windows. The lighthouse keeper also replaced the fuel, rescued shipwrecked sailors, and sometimes fired a warning cannon during periods of fog.

In 1822, Augustin Fresnel, a French physicist, invented the Fresnel lens. Initially, the Fresnel lens revolved around the lamp by means of a clocklike mechanism. But today, electric motors provide the power to revolve the lens and light the lamp.

In addition, most lighthouses are now fully automated and do not need a keeper. Nevertheless, the United States Coast Guard, which became responsible for U.S. lighthouses in 1939, still employs people to care for lighthouses and their grounds and to help prevent vandalism. Robert L. Scheina

See also **Beacon; Seven Wonders of the Ancient World; Stevenson, Robert.**

Additional resources

Gibbons, Gail. *Beacons of Light.* Morrow, 1990. Younger readers.



U.S. Coast Guard

Alligator Reef Light Station is located in the Florida Keys. Its metal stilts are screwed into the floor of the sea, and its metal skeletal tower can withstand winds of hurricane force.



U.S. Coast Guard

Boston Lighthouse, first lit in 1716, was the first lighthouse in America. The present structure was built in 1783, after the original was destroyed during the Revolutionary War.



© Larry Lee, West Light

© David R. Frazier

Lighting enables us to take part in activities we enjoy at any time we wish. Lights in sports stadiums allow fans to enjoy games at night. At home, lighting lets us read or study at any hour.

International Assn. of Lighthouse Authorities. *Lighthouses of the World.* Globe Pequot, 1998.
Noble, Dennis L. *Lighthouses & Keepers.* Naval Inst. Pr., 1997.
Shelton-Roberts, Cheryl, and Roberts, Bruce. *Lighthouse Families.* Crane Hill, 1997.

Lighting is a term that generally refers to artificial light—in most cases, electric light. We use artificial light both indoors and outdoors instead of—and in addition to—natural light from the sun. With lighting, we can use windowless areas of homes, hospitals, offices, schools, stores, and other buildings 24 hours a day. Lighting also enables us to use outdoor sports areas, such as baseball and football fields and tennis courts, at night.

Lighting provides safety in a number of places. At home and at work, good lighting helps us see things clearly and avoid accidents. Street lights and automobile lights help us travel safely. Signal lights guide motorists, airplane pilots, railroad engineers, and ship captains.

Companies and stores use lighted signs to identify themselves and to advertise their products. In addition, lighting adds beauty to homes and other buildings and to parks.

Vision depends on light, and good lighting helps the eyes work easily. Reading or working in poor light cannot damage the eyes. But it may cause fatigue or eyestrain and lead to dizziness, headaches, or sleepiness.

How we use lighting

We use artificial lighting in four chief types of locations: (1) in the home; (2) in offices, stores, and factories; (3) on streets and highways; and (4) at outdoor events. Regardless of where lighting is used, people depend on it for general seeing and safety, for specific activities, and for decoration.

In the home, electric lamps and lighting fixtures provide light and safety for people walking from room to room or up and down stairs. Every room and passageway needs at least some general lighting so that things can be seen clearly enough to avoid accidents. Each area should have a light that can be turned on before entering.

Many activities require extra lighting in addition to general lighting. Bathrooms, for example, have special lighting that people use when putting on makeup or shaving. Bedrooms and living rooms have additional lighting for such activities as reading, studying, and sewing.

Interior designers use lighting to create various moods and to bring out the colors of walls and fabrics in a home. Incandescent lamps and warm white fluorescent lamps emphasize reds, yellows, and oranges (see **Electric light** [Incandescent lamps; Fluorescent lamps]). Cool white fluorescent lamps bring out blues and greens. Many people arrange spotlights or tinted lights to create interesting shadows. Others use *accent lights* to draw attention to such objects as pictures or vases.

In offices, stores, and factories, proper lighting helps employees work efficiently and avoid costly accidents. Good lighting also provides a comfortable atmos-

phere and reduces fatigue caused by eyestrain. In retail stores, proper lighting may help attract customers or make merchandise look appealing.

Most offices and stores provide general illumination, with additional *task lighting* for such detailed jobs as repairing watches or making maps. Many factory jobs require more demanding eye work than do office jobs. Thus, factories require proper levels of lighting for safe, efficient work. In many countries, a professional association of lighting engineers, such as the Illuminating Engineering Society of North America, the Indian Society of Lighting Engineers, or the Institution of Lighting Engineers in the United Kingdom, recommends lighting standards for various types of work. Proper lighting in an office provides a comfortable level of general illumination without creating glare on computer screens. Good lighting design can improve the quality and quantity of a company's work because employees may avoid errors that they otherwise might have made.

On streets and highways, lighting helps people travel safely. Several cities have reduced night traffic accidents by improving their street lighting, some by as much as 50 percent. Freeway lights can reduce traffic deaths and injuries on these highways by a similar percentage. Street lighting also helps to provide safety and security by discouraging criminals.

Decorative lights on buildings may reduce the necessity for street lighting. In some cities, lighting designers plan light so that it accents the architecture as it illuminates the streets and sidewalks.

For outdoor events. Floodlights illuminate baseball and football fields, golf courses, race tracks, swimming pools, tennis courts, and many other facilities for sports competition at night. Some sports, such as tennis and swimming, require relatively little light. Others, including baseball and football, need much more light because they use larger fields and attract larger crowds. Additional lighting is required to televise outdoor events.

Outdoor lighting also allows such events as county or state fairs and open-air theater performances to be held at night. Country clubs, resorts, and homes use decorative lighting for night parties held outdoors.

What is good lighting

Good lighting allows the eyes to function comfortably and efficiently. The eyes need different amounts and types of light for different activities. As a result, lighting that may be suitable for some activities may be inadequate for others.

Quantity of light needed for various activities depends on four factors: (1) the size of the things we are looking at, (2) the length of time we have to look at them, (3) the contrast between them and their background, and (4) our own seeing abilities. A watchmaker, who usually works with tiny parts, requires more light than a plumber, who connects large pipes. A person needs more light to read a road sign while speeding past in a car than while walking by. A tailor needs more light to sew black thread on black cloth than to sew white thread on black cloth. Older people generally need more light than young people to perform the same seeing tasks.

In the home, most people do not provide for the wide variety in the amount of light required for different activities. For example, a woman may use the same light for reading a newspaper and for hemming a black skirt with black thread. But her eyes need almost seven times as much light for this job as for reading.

Engineers use either the *foot-candle* or the *lux* to measure the amount of light that falls on a surface. The foot-candle is a unit in the inch-pound system of measurement, and the lux is a metric unit. A sensitive instrument called a *light meter* records how much light a surface receives at that point. See **Foot-candle; Light** (Measuring light); **Light meter.**

Three factors determine how much light reaches any object: (1) the *intensity* (strength) of the light, (2) the distance of the object from the light source, and (3) the light distribution.

Intensity. Scientists measure the intensity of light coming from any source in units called *lumens.* Watts tell the amount of electric power used by a lamp, not how much light it produces. For example, a 100-watt lamp may provide only a fourth as many lumens as a 100-watt fluorescent tube. *Lamps* (bulbs) sold in many countries are labeled with both watts and lumens.

Distance. According to a principle known as the *inverse square law,* the amount of light an object receives depends on its distance from the source. An object placed 2 feet from a lamp receives only a fourth as much light as when it is placed 1 foot from the lamp.

Distribution. Dark colors absorb light, and so dark carpets, ceilings, curtains, furniture, or walls may limit the amount of light in rooms. But pale-colored walls and furnishings reflect light back into a room.

A lamp shade distributes the light from a bare bulb and shields the bulb from direct view. The shade directs light downward toward the seeing task and upward to help light the room. Opaque shades send all the light up and down, but translucent shades transmit some light to the room. Colored shades tend to color the light. For this reason, most shades have white or near-white linings.

Efficient use of lighting can conserve energy. Different types of lighting can provide different amounts of light while using the same amount of energy. For example, incandescent lamps provide 15 to 20 lumens per watt, while a standard fluorescent tube provides up to 100 lumens per watt. A compact fluorescent lamp can be used to replace an incandescent lamp, and it fits into the same lamp socket. A typical 75-watt incandescent lamp produces nearly 1,200 lumens and lasts for about 750 hours. A compact fluorescent replacement lamp uses only 20 watts and lasts about 10,000 hours.

Engineers and scientists are continually looking for ways to improve the efficiency of lamps. They have developed vapor lamps with improved efficiencies over incandescent lamps. For example, *mercury vapor lamps* provide up to 50 lumens per watt, *metal halide lamps* provide up to 90 lumens per watt, and *high pressure sodium lamps* provide up to 110 lumens per watt. The most efficient commercial light source is the *low pressure sodium vapor lamp,* which provides up to 180 lumens per watt. Vapor lamps also last longer than incandescent lamps.

Lighting problems may occur even if enough light

Examples of good lighting

These photographs show the use of proper lighting for different indoor activities. The diagrams to the right of each photograph show the light sources used and the areas they illuminate.

In an office, fluorescent lights provide even illumination on desks and other work surfaces. Lighting designers must carefully select lighting systems that do not cause glare on computer screens.



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In a large area, such as a basketball court, factory, or warehouse, an even amount of light is needed over the entire floor. Incandescent lighting fixtures near the ceiling evenly light the floor.



AP/Wide World



WORLD BOOK illustrations by Jay Bensen, Jay E. Bensen Associates

has been provided for an activity. For example, a bright light that shines, or is reflected, directly into the eyes causes glare, which can cause discomfort. Severe glare, such as that caused by the headlights of some cars, may be temporarily blinding. Lamps and fixtures that *diffuse* (scatter) the light tend to produce more comfortable illumination. Indirect lighting, in which all the light from the source is reflected from ceilings and walls, produces completely glare-free and comfortable lighting.

An unshaded clear glass bulb gives off harsh, undiffused, glaring light. Lamps with frosted or white bulbs and tubes give some diffusion, but still should be shielded or positioned so they do not shine directly in a person's field of vision. A globe or diffusion bowl can be used to conceal the bulb and help scatter and soften the light.

Even if a light source does not cause glare directly, other surfaces, such as the screens of computer monitors or glossy finishes on walls, furniture, and paper, may produce reflected glare. Sharp color contrasts on work surfaces, such as white paper on a dark blotter, may also cause discomfort. At first, the color contrast helps the eyes see the objects. However, in time the color contrast strains the eyes, which must refocus each time they move from a light surface to a dark surface.

Sharp contrasts in the brightness of lighting can also cause eyestrain. For this reason, a person should not watch television in a completely dark room or study by the light of a single intense lamp. To avoid harsh contrasts, the eyes need general lighting in addition to the light from the television screen or the lamp.

Lighting devices

Many people use combinations of fluorescent and incandescent fixtures and portable lamps for attractive home lighting. Incandescent and fluorescent fixtures may be mounted on a wall or ceiling, recessed above the ceiling, or suspended from the ceiling. Suspended fixtures provide good general lighting for high-ceilinged halls or stairways. Recessed fixtures above sinks or other work areas furnish good lighting for various activities. Portable lamps give homes soft general lighting and provide extra lighting for such activities as sewing or studying. Ceiling-mounted *track lights* can be positioned to highlight special areas.

In homes and small offices, lighting designers may conceal fluorescent tubes behind faceboards mounted at the edges of the walls or ceiling. Such *structural lighting* provides soft indirect light and draws attention to the walls and draperies. Structural lighting on two opposite walls of a square room makes the lighted walls seem farther apart than the unlighted ones. When mounted on a low ceiling, structural lights give the illusion of greater height in the room.

Most factories, offices, schools, and stores use fluo-

In an office lobby, light from fluorescent fixtures in the ceiling supplements the natural light from the windows. The artificial light reduces the contrast between the areas near the windows and the darker corners of the room.



Robert H. Glaze, Artstreet



In a home, a combination of windows and incandescent lamps and fixtures provides good light for reading. Lighting in homes should help to create a pleasant environment.



© Peter Gonzalez



WORLD BOOK illustrations by George Suyeoka

rescent or vapor fixtures for general lighting because of their energy efficiency. Such lighting also produces less heat. However, lighting engineers sometimes prefer incandescent lamps because of their compact size, flexibility of use, or their more familiar warm color. Many stores use a combination of fluorescent or vapor fixtures for general lighting and incandescent lamps for decorative and accent lighting. William Hand Allen

Related articles in *World Book* include:

Beacon
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Candle
Electric light
Fluorescent lamp
Invention (Inventions that give people light)
Lamp
Light
Neon
Theater (Lighting and sound)

Lightning is a giant electric spark in the sky. Most lightning that people see takes place between a cloud and the ground. But lightning also occurs within a cloud, between a cloud and the air, and between two clouds. Lightning in the atmosphere may damage aircraft traveling through it, but it does not cause harm on the ground. However, lightning that strikes the earth can kill people and cause fire. Lightning strikes the earth about 100 times each second. Lightning heats the air explosively, creating the sound that we hear as thunder.

A lightning flash from a cloud to the ground consists of one or more *strokes.* A stroke appears as a single brightening of a *channel* (path) between the cloud and the ground. Typical cloud-to-ground flashes are up to 10 miles (16 kilometers) long. Flashes in clouds may travel horizontally through lines of clouds for more than 100 miles (160 kilometers).

Until the mid-1700's, lightning was a great mystery of nature. The ancient Greeks and Romans thought lightning was a weapon of the gods. Some African peoples believed individuals and places hit by lightning were cursed. As late as the 1700's, some people in Europe and America thought that they could keep lightning away by ringing church bells.

In 1752, the American statesman and scientist Benjamin Franklin showed that lightning is electrical. He tied a metal key to the end of a kite string and flew the kite in a thunderstorm. Electric charges built up on the string and the key. Franklin then put his knuckle near the key. A spark jumped from the key to the knuckle.

The spark occurred because charges flowed through the air from the key to Franklin's knuckle. The charges then traveled on through Franklin's body to the ground. Franklin's experiment was dangerous; lightning has electrocuted people who have flown kites in storms. See **Franklin, Benjamin** (Experiments with electricity).

Types of lightning

Lightning occurs when electric charges flow within, from, or to a cloud. The type of cloud most often involved is known as a *cumulonimbus* or a *thundercloud.* Types of lightning can be classified in two ways: (1) by

the source and destination of the charges and (2) by the appearance of the flash.

The charges. The most common type of lightning is known as *intracloud lightning,* which occurs within a cloud. Intracloud lightning neutralizes positive and negative charges that have built up in a thundercloud. Charges that flow from the cloud to the air create *cloud-to-air lightning.* A flow of charges between two clouds—a relatively rare event—produces *cloud-to-cloud lightning.*

Lightning between a cloud and the earth may be either *cloud-to-ground lightning* or *ground-to-cloud lightning,* depending on the direction in which the charges first flow. Most of the lightning that people see is cloud-to-ground lightning that is brought about by a build-up of negative charge in the lower part of the thundercloud.

Appearance. People have given names to various aspects of lightning: *forked lightning; streak lightning; ribbon lightning; bead lightning,* also called *chain lightning; heat lightning; sheet lightning;* and *ball lightning.* Forked lightning is a flash that has several visible branches. Streak lightning appears to illuminate a single jagged line. Ribbon lightning appears as parallel streaks of light. It occurs when wind separates the individual strokes of a flash. Bead or chain lightning is a flash that breaks up into a dotted line as it ends.

Heat lightning, often seen on summer nights, seems to occur without thunder. Actually, it is lightning that occurs so far away from an observer that its accompanying thunder cannot be heard. Generally, the distance from the observer is beyond about 15 miles (24 kilometers). But the people underneath heat lightning experience a normal thunderstorm.

Sheet lightning appears as an illumination of part of the sky. The flashes that produce sheet lightning are either so far away that their characteristic shape cannot be seen, or the flashes are hidden by clouds.

Ball lightning usually occurs after a cloud-to-ground flash. It appears as a glowing, fiery ball that floats for several seconds before disappearing. People have reported similar observations of ball lightning for more than 2,000 years.

Individuals have seen ball lightning floating along the ground and inside houses, barns, and even airplanes. Observers commonly describe it as red, yellow, or orange, and typically between the size of an orange and the size of a basketball. There are many theories of how ball lightning forms, but none has been proven by creating ball lightning in a laboratory.

How lightning develops

Charges in a cloud. The development of all types of lightning begins with a cloud becoming electrically charged. Most researchers believe that charging occurs when various forms of water and ice within the cloud collide with one another.

Light droplets of water and tiny pieces of ice that are rising in updrafts within the cloud collide with heavier hail that is falling. Interactions between colliding cloud particles makes negatively charged subatomic particles called *electrons* jump from atoms in rising ice to atoms in falling hail. The transfer of electrons alters the electrical balance of the atoms.

Normally, an atom is electrically neutral. It consists of a positively charged *nucleus* and one or more electrons in orbit around the nucleus. The nucleus consists of at least one positively charged *proton* and—in all atoms except those of the simplest form of hydrogen—one or more electrically neutral particles known as *neutrons.* The atom as a whole is electrically neutral because the number of electrons equals the number of protons.

When electrons jump from rising ice to falling hail in the cloud, the ice becomes positively charged, and the hail becomes negatively charged. Eventually, a major separation of charge occurs throughout the cloud: The top of the cloud becomes positively charged, and the bottom becomes negatively charged. In addition, other interactions between cloud particles create a small positively charged region below the major negative region.

A channel of charge. What happens next determines what type of lightning occurs. The following description applies to cloud-to-ground lightning. Other types of lightning occur in a similar manner.

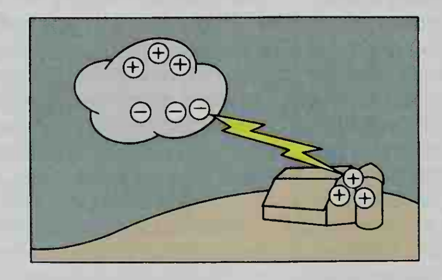
The next process occurs because the bottom of the cloud is more negative than the ground beneath the cloud. Charges tend to flow from an area where there is a large concentration of charge to an area of small concentration.

Electrical discharges provide the paths for this charge motion. In a discharge that begins in the negatively charged region of the cloud, *free electrons* move from the bottom of the cloud toward the ground. A free electron is one that is not attached to an atom or molecule. In moving toward the ground, the free electrons form spark channels. In doing so, the electrons strike air atoms and molecules, liberating electrons from them. The atoms and molecules become positively charged—scientists refer to them as *positive ions.*

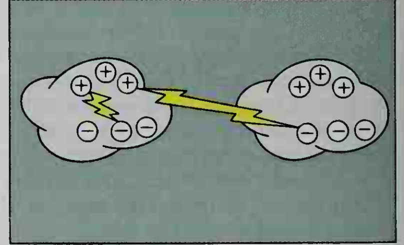
The newly freed electrons, in turn, strike more air

Types of lightning

Lightning occurs when electric charges flow from, within, or to a cloud. When negative charges flow from the bottom of a cloud to the ground, *cloud-to-ground* lightning occurs. Lightning caused by a flow of charges within a cloud is *intracloud lightning.* Lightning that results from a charge flow between clouds is *cloud-to-cloud lightning.*



Cloud-to-ground lightning



WORLD BOOK diagrams by Arthur Grebetz

Intracloud and cloud-to-cloud lightning

molecules, liberating even more electrons and creating even more positive ions. This process continues as an *electron avalanche,* creating a long, tubelike spark channel, or discharge channel. The channel is composed of free electrons, positive ions, and neutral air atoms at high temperature.

The channel moves downward in a succession of steps, and so it is known as a *stepped leader.* Each step is about 50 yards or meters long and forms in about 1 millionth of a second. There is a pause of about 50 millionths of a second between steps. The stepped leader acts as a *conductor* (carrier) of charges.

A channel from the ground. When the stepped leader is within about 50 to 100 yards or meters of the ground, another process creates a leader that moves upward from the ground. This process liberates electrons, which flow to the ground. As a result, the upward-moving leader becomes positively charged.

A stroke of lightning. The stepped leader and the the upward-moving leader meet, creating a conducting channel that extends from the bottom of the cloud to the ground. Free electrons in the channel and the cloud eventually flow through the channel to the ground. The electrons where the two leaders touch are the first to move downward. Then electrons at successively higher levels in the conducting channel move downward.

Scientists refer to the upper electrons that are moving downward at any given time as the *front* of electrons. And, although the electrons are moving downward, the front is moving upward. The upward movement of the front is known as the *return stroke.*

The return stroke creates light and heats the air. We see the upward-moving light as the bright light that we call lightning. The heat of the return stroke produces a wave of air pressure that we hear as thunder.

Return strokes travel at about half the speed of light, or at about 93,000 miles (150,000 kilometers) per second. They discharge about 100 million volts of electric potential and heat the air in their paths to more than 60,000 °F (33,000 °C).

Dart leaders. The flash may end after one return stroke. But in most cases, *dart leaders,* which are similar to stepped leaders, carry additional electrons from the cloud down the main path of the previous stroke. A return stroke follows each dart leader. The leader-return stroke process commonly occurs 3 or 4 times in one flash, but it may occur more than 20 times. People can sometimes see the individual strokes of a flash. At such times, the lightning appears to flicker.



© Leo Starz

Lightning is a giant electrical spark in the sky. It often strikes tall buildings, *shown here,* and may do little damage. But lightning can kill people, destroy property, or cause fire.

Protection from lightning

People can avoid being struck by lightning by following certain safety measures, such as those listed below, during thunderstorms.

(1) Take shelter in a house or a large building.

(2) If you are in an enclosed metal car or truck, it is safe to stay there with the windows rolled up, but do not touch any metal inside the vehicle.

(3) Stay away from open metal vehicles, such as bicycles, golf carts, farm equipment, and motorcycles.

(4) Do not use a telephone that has a cord connecting the handset to the base—except in an emergency.

(5) If you are caught in an open area, sit or crouch.

(6) Do not stand under or near an isolated tall tree or any similar tall object in an open area.

(7) Do not rise above the landscape by standing on a hilltop, on a beach, or in an open field.

(8) Stay out of and away from water.

Metal poles called *lightning rods* help protect buildings from lightning damage. They are attached to building tops. A lightning rod attracts lightning that would otherwise strike the building. The electric charges flow through a wire or cable safely attached to the rods to the ground. Martin A. Uman

See also **Cloud; Lightning rod; Shock wave; Thunder.**

Additional resources

Frydenlund, Marvin M. *Lightning Protection for People and Property.* Van Nostrand, 1993.

Galiano, Dean. *Thunderstorms and Lightning.* Rosen Central, 2000. Younger readers.

Uman, Martin A. *All About Lightning.* 1971. Reprint. Dover, 1986. *The Lightning Discharge.* Academic Pr., 1987.

Lightning bug. See Firefly.

Lightning rod is a device that protects homes and other buildings from damage by lightning. A common type has a metal rod installed on top of a building. A wire or cable leads from this rod to a *ground rod* buried 10 feet (3 meters) or more in the earth. The ground rod should be buried at least 2 feet (61 centimeters) from the building in moist earth. It should be as straight as possible. If a building has several metal supports, each should be connected to a lightning rod and there should be several ground connections.

Lightning rods are most often used in farming regions to protect homes, barns, and windmills. They are not often seen in cities, because there is so much metal used and the buildings stand close together. Other kinds of lightning protectors are used on power stations, telephone wires, and electric structures.

Donald T. Acheson

Lignin, *LIHG nihn,* is a complex substance formed by certain plant cells. It is the substance in wood that makes wood stiff. Lignin is found in the cell walls of woody tissue and is similar to plant cellulose. It is made up of chains of repeating carbohydrate molecules called *polymers.* Lignin, like cellulose, permits water and gases to pass through it. In the manufacture of paper, lignin is removed from wood by treating the wood fibers with sodium sulfite, sodium hydroxide, or a mixture of sodium hydroxide and sodium sulfide.

Although lignin is primarily a waste product in paper manufacturing, some lignin is now used as fuel in paper-pulp mills. It is also used in making plastics, fertilizer, artificial vanilla, cosmetics, building board, rubber, fire extinguishers, and other items. David S. Seigler

Lignite, also called *brown coal,* is a low-quality coal. Lignite contains 20 to 60 per cent water when mined, much more than coal of higher quality. When burned, lignite produces only about half as much heat as other coals. In the United States, it is produced in Montana, North Dakota, and Texas, and is used locally. See also **Coal** (The uses of coal; How coal was formed).

William Hustrulid

Lignum-vitae, *LIHG nuhm VY tee,* is the name of two species of trees that produce extremely hard wood. The trees grow in the West Indies, Mexico, Central America, and northern South America. They are sometimes called *guayacans.* The Latin words *lignum vitae* mean *wood of life.* The trees were so named because resin made from their wood was used to treat rheumatism, catarrh, and skin diseases.

The heartwood of a lignum-vitae is the most useful part of the tree. This wood is so heavy that it sinks in water. The wood is olive-brown in color and contains an oily resin that acts as a lubricant when the wood is used for bearings. The grain of lignum-vitae interlocks and makes it practically impossible for the wood to be split. Lignum-vitae is used for the stern propeller-shaft bearings in steamships, for the sheaves and blocks of pulleys, and for mallets, furniture casters, and band saw guides.

Scientific classification. Lignum-vitaes belong to the caltrop family, Zygophyllaceae. The scientific names for the two species are *Guaiacum officinale* and *G. sanctum.*

Jim L. Bowyer

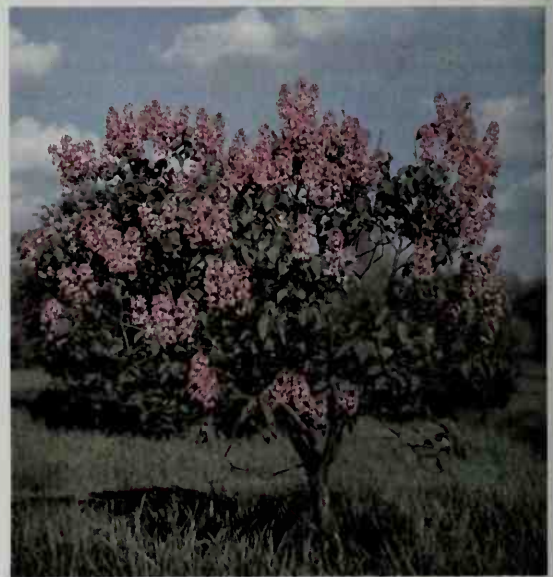
Liguest, Pierre L. See Saint Louis (History).

Liguori, Saint Alphonsus. See Alphonsus Liguori, Saint.

Ligurian Sea, *lih GYOO rih uhn,* is a broad portion of the Mediterranean Sea located between the Italian region of Liguria and the island of Corsica. The Gulf of Genoa forms the northern part of this sea. For location, see **Italy** (terrain map). Howell C. Lloyd

Lij Iyasu. See **Ethiopia** (History).

Lilac is a beautiful shrub that is loved throughout the world for its fragrant flowers. The *common lilac* from southeastern Europe grows to a height of 20 feet (6 meters) and has wide, spreading branches thick with flowers. Its green leaves are about 5 inches (13 centimeters) long. The white or purple flowers grow in clusters that



Morton Arboretum

The beautiful lilac is popular throughout the world. The common lilac, *above,* grows wild in southeastern Europe. Nurseries have developed many varieties of this plant. In spring, lilacs blossom with clusters of fragrant flowers, *below.*

Grant Heilman



may be 10 inches (25 centimeters) long. Lilac bushes can be grown in almost any garden, and the plant needs little attention. Lilacs may be grown by cuttings from green lilac wood, ripe wood, or roots. Some kinds of lilacs are grown by grafting or budding. Lilacs grow best in northern climates. In the northern states, most lilacs bloom in May. Nurseries have developed many different kinds which have larger and more colorful blossoms than the common lilac. Their colors vary from white to dark purple and deep red.

Lilacs can be made to bloom in the winter by keeping them under glass. The plants are put in pots in the spring and taken outdoors later in the summer. The plants bloom in three to five weeks if they are kept in a temperature from 60 °F to 80 °F (16 °C to 27 °C).

A light purple color is called "lilac" after the lovely light purple flowers of some lilacs. Many poets have written about the beauty of lilacs. Perhaps the most beautiful of such poems is the ode Walt Whitman wrote on Lincoln's death, called "When Lilacs Last in the Dooryard Bloom'd." Michael A. Dirr

Scientific classification. Lilacs belong to the olive family, Oleaceae. The scientific name for the common lilac is *Syringa vulgaris.*

Lilienthal, *LIHL ee uhn THAWL,* **David Eli,** *EE ly* (1899-1981), was the first chairperson of the United States Atomic Energy Commission. He was appointed by President Harry S. Truman in 1946 and served until 1950. As chairperson, he worked to establish public use and civilian control of nuclear energy. Lilienthal also was a director of the Tennessee Valley Authority (TVA) from 1933 to 1946 and chairperson of TVA from 1941 to 1946. At TVA, he vigorously promoted both government production of electric power and locally based regional planning. He wrote *TVA: Democracy on the March* (1944).

Lilienthal was born on July 8, 1899, in Morton, Illinois. He graduated from DePauw University and Harvard University Law School. Alonzo L. Hamby

Liliuokalani, *lee LEE oo oh kah LAH nee,* **Lydia Kamekeha,** *LIHD ee uh KAH meh KEH hah* (1838-1917), reigned as queen of Hawaii from 1891 to 1893. She became queen after the death of her brother, King David Kalakaua. In 1893 Liliuokalani tried to restore some of the monarchy's power through the political movement called Oni Pa'a (Stand Firm). But American settlers who controlled most of Hawaii's wealth disapproved of the queen's efforts and revolted against her. A republic was established in 1894. United States President Grover Cleveland tried in vain to restore Liliuokalani to her throne. Hawaii became a U.S. territory in 1898.

Liliuokalani made two trips to the United States after she lost her throne. She is perhaps best known today for her song, "Aloha Oe," which became Hawaii's traditional farewell song. She was born on Sept. 2, 1838, in Honolulu, Hawaii. Edward A. Lukes-Lukaszewski

See also **Dole, Sanford Ballard; Hawaii** (History).

Lille, *leel* (pop. 191,164; met. area pop. 1,000,900), is an industrial city in northern France. For the location of Lille, see **France** (political map). The city is a center of textile production. Other major industries include the production of automobiles, electronic equipment, and petrochemicals. Thousands of tourists visit Lille each year. Its art museum has paintings by the Flemish artists Peter Paul Rubens and Anthony Van Dyck, the Spanish artist Francisco Goya, and others.

Lille was founded about 1030 by the Flemish. The government of Flanders gave it to France in 1312. Eugene, Prince of Savoy, captured the city in 1708, but the Peace of Utrecht in 1713 restored it to France. German troops captured and occupied Lille in World War I (1914-1918) and in World War II (1939-1945). William M. Reddy

Lillie, Beatrice (1898-1989), a Canadian-born actress, won fame as one of the brightest and most natural comediennes of her time. She appeared in more than 50 shows. Lillie was a brilliant cabaret and revue performer, alternating slapstick comedy, vulgarity, and grandeur.



Wide World

Beatrice Lillie

Lillie was born on May 29, 1898, in Toronto, Ontario. She settled in England in 1914 and made her English stage debut that same year. She received the name Lady Peel after she married Sir Robert Peel in 1920. Lillie became a star in the United States with her performance in *Charlot's Revue* in New York City in 1924. Lillie wrote an autobiography, *Every Other Inch a Lady* (1972). J. P. Wearing

Lilly Endowment is one of the largest private foundations in the United States. The foundation makes charitable grants to support religion, education, and community development. The endowment was established in 1937 with gifts from members of the family that founded and directed the Eli Lilly and Company pharmaceutical firm. The foundation's headquarters are in Indianapolis. For assets, see **Foundations** (table).

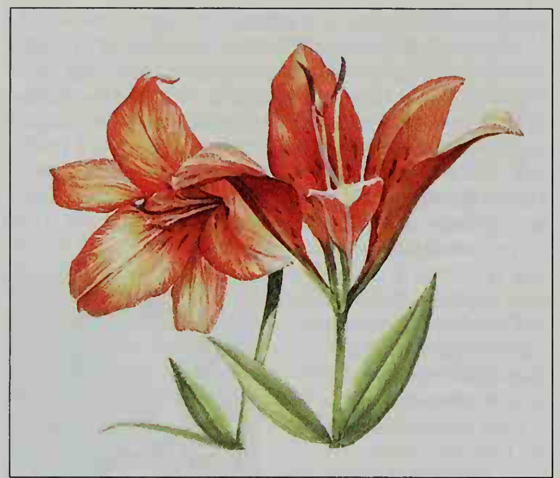
Critically reviewed by Lilly Endowment Inc.

Lilongwe, *lih LAWNG way* (pop. 223,973) is the capital of Malawi, in southeast Africa. The city lies on the Lilongwe River in the heart of Malawi's agricultural area and is a marketing center for tobacco and other crops. For location, see **Malawi** (map).

Lilongwe was settled in 1902. It became a city in 1966, when it was designated to replace Zomba as the Malawi capital. At that time, fewer than 20,000 people lived in Lilongwe. The city's population climbed during the several years of an extensive government construction program that included factories, government buildings, and residential areas. Lilongwe officially became the capital in 1975. John D. Metzler

Lily is one of the largest and most important plant families. The name is used for many garden and hothouse flowers, such as the tiger lily, the Madonna lily, the white Easter lily, and the Chinese and Japanese lilies. The lily family also includes a number of plants that are important to agriculture, such as asparagus and aloe. A few flowers which do not have *lily* as part of their name, such as the hyacinth and the trillium, are also in the lily family. But the calla lily and water lily are not members of the lily family.

There are more than 200 genera in the lily family, with about 4,000 species. Twelve species of true lilies are native to the United States. The *meadow lily* of the southeast is reddish-orange with purple spots and grows



WORLD BOOK illustration by Robert Hynes

Wood lilies have bright, orange-red petals with purple spots. These flowers are found from the Midwestern States to New England. There are about 4,000 species of lilies.

up to 5 feet (1.5 meters) tall. The *southern red lily* also grows along the southeastern coast. It is about 2 feet (0.6 meter) high with bright red and yellow flowers spotted with purple.

The tall *leopard lily* grows along the west coast from California to Oregon. It is about 6 feet (1.8 meters) high with reddish-orange flowers spotted purple. The *Sierra lily* of the same region is about 5 feet (1.5 meters) tall. It has red-orange flowers that are also purple-spotted.

The *wood lily* grows from Maine to Missouri. Its flowers are also orange-red with purple spots, and it grows to a height of 3 feet (0.9 meter).

Lily flowers grow from scaly bulbs. Most lilies have clusters of bright-colored flowers on upright stems. The blossoms are trumpet-shaped and have six petals.

Lilies grow best in deep, sandy loam that is well drained. They should be sheltered from strong winds and hot sun. Bulbs of most lilies are planted 6 inches (15 centimeters) or more under the soil in late fall or early spring. They are placed deep because many produce roots from the stem above the bulbs. As soon as the plants bloom, the seed pods should be removed. The *Madonna lily* is planted only in August and is set only 2 inches (5 centimeters) deep because it starts a growth of foliage in late summer. It lives through the winter.

The most serious disease that attacks lilies is called *mosaic virus*. It is carried from plant to plant by aphids and attacks every part of the plant except the seeds. When one of the plants becomes infected, it should be removed immediately and destroyed. Another disease, called *Botrytis blight*, also attacks lilies. It can be controlled by spraying the flowers once a week with appropriate *fungicides* (substances that kill fungi).

August A. De Hertogh

Scientific classification. True lilies belong to the lily family, Liliaceae. They are genus *Lilium*.

Related articles in *World Book* include:

Aloe	Bulb	Day lily
Asparagus	Colchicum	Dogtooth violet
Aspidistra	Crocus	Easter lily
Flower (pictures)	Mariposa lily	Squill
Fritillary	Mosaic disease	Star-of-Bethlehem
Greenbrier	Sego lily	Tiger lily
Hyacinth	Soap plant	Trillium
Lily of the valley	Solomon's-seal	Tulip

Lily, Water. See Water lily.

Lily of the valley is a fragrant garden flower. Each blossom is shaped like a tiny bell. It grows in North America, Europe, and northern Asia. Wild lily of the valley grows in the southern Allegheny regions of eastern North America. The lily of the valley is one of the special flowers for the month of May. It is called the *may bell* in Germany.

The beautiful bell-shaped flowers are pure white. They hang down in a long cluster along a slender stem. The flower stalk rises from a *rhizome* (underground stem). Each stalk usually has two or three wide, oblong leaves. The fruit of the plant is a red berry about $\frac{1}{4}$ inch (6 millimeters) in diameter. The plant requires rich, well-drained soil with leaf mold and grows well in shade.

Lily of the valley is a perennial plant, flowering naturally in late spring. In greenhouses, it blooms during all seasons. Professional growers keep the plant's rhizome, called a *pip*, frozen at temperatures from 25 to 28 °F (−4 to −2 °C) until it is planted for flowering. The plant will grow outdoors for many years without needing to be moved. In greenhouses, it should be kept at a temperature of about 65 °F (18 °C) in order to bloom.



Derek Fell

The lily of the valley has white, bell-shaped blossoms.

Lily of the valley is famous for its fragrance. A French toilet water called *eau d'or* is made from the flowers.

August A. De Hertogh

Scientific classification. Lily of the valley is a member of the lily family, Liliaceae. It is *Convallaria majalis*. The scientific name for the wild lily of the valley found in the United States is *C. montana*.

Lima, *LEE muh* (pop. 5,706,127; met. area pop. 6,414,500), is the capital and largest city of Peru. It is the nation's major commercial, cultural, and industrial cen-



Victor Englebert, Black Star

The Plaza de Armas in Lima, Peru, marks the historic center of the city. Such major buildings as the cathedral shown above, the city hall, and the Government Palace face the square. The cathedral stands on the site of an earlier church built when Lima was founded in 1535.

ter. Lima lies in western Peru, about 8 miles (13 kilometers) from the Pacific Ocean. For location, see **Peru** (political map). The Lima metropolitan area extends west to the Pacific. The Andes Mountains rise east of the area.

The city. The Plaza San Martín lies in the center of Lima. The Colmena, Lima's main highway, runs east and west through the plaza. Hotels, office buildings, theaters, and private clubs surround the plaza. Farther south lies the Plaza de Armas, the original center of Lima. Several historic buildings face this square, including the Cathedral of Lima, the city hall, baroque churches, and the Government Palace. Tall, modern buildings line the streets of the business district near the Plaza San Martín. Lima also has many mansions that were built when Peru was a colony of Spain—from the 1530's to the early 1800's. Many of these mansions are now government office buildings, museums, or restaurants.

Wealthy families live in some of the colonial mansions. Other residents of Lima occupy apartment buildings or luxurious dwellings in Miraflores and other wealthy suburbs. However, many of the city's residents live in public housing or inner-city slums. More than a third of the population lives in squatter communities called *young towns,* which surround Lima. Many of the houses in these communities are little more than huts made of bamboo, cardboard, straw, and tin.

Most of Lima's people are of Spanish or mixed Indian and Spanish ancestry. Most are Spanish speaking. A small number speak Quechua, the language of the Inca Indians.

Attractions of Lima include the Museum of Peruvian Culture and the National Museum of Art. The ruins of Pachacamac, an ancient Indian city, lie nearby. The National Library of Peru and the University of San Marcos, the oldest university in South America, are in Lima (see **San Marcos, University of**). The city has a symphony orchestra and a national theater group. Motion pictures and soccer and other sports are favorite recreations among Lima's people.

Economy of Lima is based on the activities of the national government. The government is the city's largest employer. Lima is also Peru's leading commercial and manufacturing center. Major products include beer, clothing, textiles, and fish meal. Museums and other cultural features in and near Lima help attract tourists. The nearby coastal city of Callao has a port and an airport that serve the capital.

History. Francisco Pizarro, a Spanish adventurer, conquered most of Peru in 1532 and 1533 and founded Lima in 1535. During the 1600's and 1700's, Lima served as the center of Spanish government in South America.

Most of Lima's industrial growth occurred during the 1900's. After the mid-1900's, many people moved to the city from rural areas and small communities to seek employment. These migrations increased housing shortages in Lima. Today, the city also faces pollution problems caused by its expanding industries and the growing number of automobiles. Joseph A. Gagliano

See also **Peru** (pictures).

Lima bean, *LY muh,* is the most nutritious member of the pea family. It is high in protein value, and rich in iron, calcium, and vitamins. This wide, flat bean first grew in tropical America. It now grows in many warm lands, especially the United States.

Like other beans, limas are seeds that grow in pods. The large limas often grow 1 inch (25 millimeters) wide and $\frac{1}{4}$ inch (6 millimeters) thick. Some varieties have large seeds and others have small seeds. Lima beans may be green or white.

Some limas grow on vines that can be trained on poles or trellises. The pole beans are usually planted in hills, 2 to 4 feet (61 to 122 centimeters) apart. Other kinds of limas grow on bushes. Lima beans grow best in rich soil that does not have too much nitrogen. They need moist air and a long growing season. Albert Liptay

Scientific classification. Lima beans are of the pea family, Fabaceae or Leguminosae. They are *Phaseolus limensis.*

See also **Bean**.

Limbo, in Roman Catholic theology, is the home of souls who belong neither in heaven nor in hell. *Limbo* is a Latin word that means *on the border.* Souls in limbo enjoy perfect natural happiness but lack the supernatural joy of seeing God.

Roman Catholic theologians have developed two concepts of limbo. *Limbus patrum* (fathers' limbo) is the temporary place or state of the souls of holy people who died before Christian times. Many Christians believe that after Jesus Christ rose from the dead, He took these souls to heaven. *Limbus infantium* (infants' limbo) is the eternal place or state of infants who have died unbaptized. The idea of *limbus infantium* rests on the belief that baptism is needed to enter heaven but that unbaptized infants have not sinned and thus do not deserve hell. Many Roman Catholic theologians have taught the existence of *limbus infantium,* but it is not part of official church doctrine. Jill Raitt

Limbourg, *LIHM burkh,* **Pol de,** *pahl duh* (? -1416), and his brothers Herman and Jean were noted manuscript painters called *illuminators.* Illuminated manuscripts are richly illustrated with miniature paintings and decorated borders. The Limbourgs worked in France for the Duc de Berry, a wealthy art patron. Their most famous manuscript for the duke was a prayer book called *Les Très Riches Heures* (*The Very Rich Hours*). One section of the book is a calendar showing the activities of each month. In the vividly colored illuminations, beautiful lords and ladies amuse themselves while peasants work in front of exquisitely painted castles. Scenes from the book appear in the articles **Europe; Middle Ages;** and **World, History of the.** The Limbourgs were born in Nijmegen, the Netherlands. Ann Friedman

Lime is a rounded fruit that is pointed at both ends. It is greener than the lemon, to which it is related. It grows on a small citrus tree. The lime tree comes from South or Southeast Asia. It now grows in the Mediterranean basin, the West Indies, Mexico, Florida, and southern California. Lime trees grow well in southern Florida, where most United States limes are produced. The type most commonly sold in the United States is the Persian lime, but the smaller Key lime is also sometimes available.

The lime tree rarely grows higher than 10 to 12 feet (3 to 3.7 meters). The fruit is important as a source of lime juice and oil of lime, which are used to flavor beverages and food. Wilfred F. Wardowski

Scientific classification. Lime trees belong to the rue family, Rutaceae. The Persian lime is *Citrus latifolia.* The Key lime is *C. aurantiifolia.*

Lime is an important industrial chemical. The chemical name for lime is *calcium oxide,* and its chemical formula is CaO. The word *lime* is also used to refer to *calcium hydroxide.* Calcium hydroxide, which has a chemical formula of $Ca(OH)_2$, is formed by a reaction of calcium oxide with water. Calcium oxide is also known as *quicklime,* and calcium hydroxide is also called *slaked lime* and *hydrated lime.* Both substances are bases.

Slaked lime has a wide variety of uses. It serves as a *flux* in the production of steel (see **Flux**). It also is used in the refining of aluminum, copper, and zinc. Lime "softens" water by removing certain minerals from it, and it plays a valuable role in the treatment of sewage as well. Many farmers spread lime on their fields to neutralize acid in soil, and homeowners often use lime on their lawns to prevent the growth of moss. Lime also helps



WORLD BOOK illustration by Kate Lloyd-Jones, Linden Artists Ltd.

Limes are green citrus fruits that grow in clusters.



J. R. Brooks & Son

Lime trees have dense foliage and small, purple-tinged flowers. Growers plant the trees in groves. The blossoms appear mainly in spring, and the fruit ripens in three to four months.

stabilize soil in the foundations of highways and airport runways. In the production of leather, tanneries use lime to remove hair from animal hides. The *mortar* that is layered between bricks or stones in the walls of buildings is composed of a mixture of lime, sand, and water. Lime is also a key ingredient in plaster and in a kind of cement called *portland cement.*

Most quicklime is made from small chunks of limestone. Limestone consists chiefly of calcium carbonate, which has the chemical formula $CaCO_3$. To produce quicklime, manufacturers place crushed limestone in a special oven, called a *kiln,* and heat it to a temperature of about 2000° F. (1204° C). This process releases carbon dioxide from the limestone, leaving a lump of powdery, grayish-white quicklime.

The production of slaked lime involves a further process called *slaking.* Water is added to a lump of cooled quicklime, resulting in a chemical reaction that produces heat and steam. As the steam evaporates, the lump of quicklime disintegrates into a fine, dry, white powder. This powder is slaked lime. If water is added in excess of the amount needed for slaked lime, a *slurry* (soupy mixture) of partially dissolved lime is created. This slurry is commonly known as *milk of lime.* When slaked lime is dissolved completely in water, the resulting product is a clear liquid called *limewater.* Limewater is used to detect the presence of carbon dioxide in a substance. If carbon dioxide is present, it turns the limewater milky-white. Robert J. Ouellette

Related articles in *World Book* include:

Calcium
Calcium carbonate
Cement and concrete (How cement is made)
Glass (Soda-lime glass)
Leather (Preparing the hides)
Limestone

Lime tree. See **Linden.**

Limerick, *LIHM uhr ihk* (pop. 56,279), is the third largest city of the Republic of Ireland. Only Dublin and Cork are larger. Limerick lies in western Ireland, at the mouth of the River Shannon. For location, see **Ireland** (map).

English Town, Limerick's oldest district, lies on an island in the Shannon. It and Irish Town, a district south of the river, have historic buildings and residential areas. Newtown-Pery, southwest of Irish Town, is Limerick's main business district and a residential area. Modern suburbs lie south of the city and north of the Shannon.

Limerick is the main port on Ireland's west coast. The city is a center of manufacturing, commerce, education, and health care. Its industries include food processing and the manufacture of cement, electrical goods, electronic products, and medical appliances.

Vikings founded Limerick about A.D. 900, when they settled on the island that later became English Town. The city gradually grew to include the Irish Town area. Newtown-Pery was created from a city plan during the 1700's. In 1939, Shannon Airport opened near Limerick. It has greatly increased tourism in the city. The airport and a large manufacturing center that was later built beside it have also provided many jobs for Limerick's people. Desmond A. Gillmor

Limerick, *LIHM uhr ihk,* is a form of humorous verse. It takes its name from the city of Limerick, Ireland. No one knows how or where the form originated. The limerick is a poem of five lines written in *Poulter's Measure,* a Folk Meter that consists of 13 beats (see **Poetry** [Stress meters]). The first two lines rhyme with the fifth. The third line rhymes with the fourth

Limericks may cover a wide range of subjects. The first line often begins: "There was a . . ." and ends with the name of a person or place. The last line ends with an unusual or far-fetched rhyme. Edward Lear's *A Book of Nonsense* (1846) made the form popular. The following is a typical limerick by Lear:

> There was a young lady of Wilts,
> Who walked up to Scotland on stilts;
> When they said it is shocking
> To show so much stocking,
> She answered, "Then what about kilts?"

Paul B. Diehl

Limestone is a type of rock made up mostly of calcite, a mineral form of calcium carbonate. Most limestone is gray, but all colors of limestone from white to black have been found. Scientists test natural rock to see if it is limestone by pouring cold diluted hydrochloric or sulfuric acid on it. Limestone gives off bubbles of carbon dioxide.

Most fresh water and sea water contain dissolved calcium carbonate. All limestones are formed when the calcium carbonate crystallizes out of solution. It leaves the solution in many ways, and each way produces a different kind of limestone. All the different kinds can be divided into two groups.

The first group includes limestones that formed almost completely without the aid of organisms. This type of limestone is forced out of solution when the water evaporates. Such evaporation takes place in the hot lagoons of many coral reefs, and in most shallow tropical seas. The high temperature causes the water on the surface to evaporate. A white "lime" mud is deposited on the bottom of the sea. This white mud slowly hardens into a light-colored limestone with a fine grain and even layers. Chalk is a limestone that remained soft.

When spring water evaporates on land, calcium carbonate forms a crust over moss, dead leaves, and the ground. It builds up a mound or terrace called *tufa.* Evaporation of water in limestone caverns forms another variety of limestone, called travertine, into stalactites and stalagmites (see **Stalactite; Stalagmite**).

The second group of limestones forms by the work of organisms. Many aquatic organisms draw calcium



Grant Heilman

Gray limestone is the most common type. Limestone also occurs in many other colors.



Grant Heilman

Limestone called coquina, which occurs in Florida, is made up of coral and shells.

carbonate out of the water and use it to make their shells and bones. The oysters, clams, snails, corals, and sea urchins do this. When the animals die, the shells and bones are broken up by waves into shell and coral sand and mud. Many of the beaches on Pacific islands are made of such coral mud and sand. Most of the limestone layers in all parts of the earth were once shell or coral sand and mud. A limestone called *coquina,* formed of shells and coral, occurs in Florida. It is used to make roads and in building.

Limestone makes an excellent building stone because it can be carved easily. Like sandstone, it can be cut any way without splitting. For this reason, both limestone and sandstone are often called *freestone.* Limestone is especially good for foundations and walls where a high polish is not needed. Quarries in Indiana produce about half the building limestone in the United States.

Some factories use limestone to clean waste gases and water before releasing them into the environment. Limestone is also used to make lime and to smelt iron ore (see **Iron and steel** [Raw materials]).

Robert W. Charles

Related articles in *World Book* include:

Building stone
Calcite
Carbonate
Cement and concrete
Chalk
Coral
Dolomite
Lime
Marble
Quarrying
Rock (Sedimentary rock)
Travertine

Limewater. See **Lime** (Chemical).

Limitation of armaments. See **Arms control**.

Limitations, Statute of. See **Statute of limitations**.

Limited company is a business organization in which each shareholder is responsible only for the shares he or she holds. A person owning stock worth $500 loses only that $500 investment if the company goes into debt. Creditors cannot sue the investor to recover money owed by the company. In Great Britain and many other nations, the word *Limited* (*Ltd.*) after a company's name indicates that the liability of investors in the firm is limited to the amount each has invested.

Robert B. Carson

Limnology, *lihm NAHL uh jee,* is the scientific study of lakes, streams, ponds, and other bodies of fresh water. Limnologists study the chemical and physical characteristics of these bodies of water. They also study the plants and animals that live in fresh water, and their relationship to each other and to their environment. Limnology is related to *ecology,* the study of the relations between organisms and their environments. Limnology has special importance in the management of fish for economic and recreational purposes. Eric G. Bolen

See also **Ecology**.

Limón, *lee MAWN,* **José,** *hoh SAY* (1908-1972), was an American dancer and *choreographer* (dance creator). Although he did not begin dancing until he was in his 20's, he achieved remarkable technical skill. Many of his ballets are based on literature. These include *The Moor's Pavane* (1949), a ballet of Shakespeare's *Othello.* Limón based several ballets on the Bible. *The Traitor* (1954) deals with Judas Iscariot's betrayal of Christ. *There Is a Time* (1956) is based on the Book of Ecclesiastes.

Limón was born in Culiacán, Mexico, and was brought to the United States when he was 7. He performed with the Humphrey-Weidman company from 1930 to 1940. He formed his own group in the late 1940's. Doris Humphrey, the group's artistic director, created many dance roles for him. Katy Matheson

Limonite, *LY muh nyt,* is a yellowish or brownish mineral deposit. It is a kind of iron ore composed of varying amounts of the minerals goethite, hematite, and lepidocrocite.

Limonite results from the breakdown and weathering of other minerals that contain iron. It may occur as a surface film on rocks, as ordinary rust, or as a slimy deposit in lakes and marshes. Limonite also may appear as the coloring material in yellow clays and soils. It is the source of *ocher,* a yellow powder used in paints and pigments.

Limonite is found in large amounts in Cuba, in eastern France, and in the Labrador Trough region of eastern Canada. *Limonite* originally referred to a type of iron deposit now called *bog iron ore.* Finley C. Bishop

See also **Iron and steel** (Kinds of iron ore).

Limpet is a sea animal with a protective shell. It lives along rocky coasts in many parts of the world. Most limpets are less than 3 inches (8 centimeters) long, but a west Mexican limpet grows to 8 inches (20 centimeters) in length. Limpets are easy to find at low tide. Their shells can be seen on exposed rocks, and resemble tiny saucers turned upside down. In most limpets, the shell completely covers the animal and protects it from hungry crabs and sea birds. Beneath the shell, the limpet's powerful, muscular *foot* clamps its body firmly to the rock by suction. At high tide, the limpet moves over rocks in search of seaweeds. It gathers food into its mouth with a *radula* (long ribbonlike tongue), which bears rows of teeth. Before the tide goes out, the limpet returns to its original resting place on the rock.



R. F. Thomas, Bruce Coleman Inc.

The limpet, a small sea mollusk, uses a muscular organ called a *foot* to cling to rocks and search for food.

See also **Animal** (picture: Animals of the oceans); **Mollusk; Snail; Shell** (picture).

Scientific classification. Limpets are in the phylum Mollusca. The northeast American limpet is a member of the limpet family, Acmaeidae. Its scientific name is *Collisella testudinalis.*

Robert Robertson

Limpopo River, *lihm POH poh,* is an important river that flows for about 1,000 miles (1,600 kilometers) in southeastern Africa (see **South Africa** [terrain map]). The Limpopo rises in the highlands and separates the

Northern Province of South Africa from Botswana and Zimbabwe before it crosses Mozambique to the Indian Ocean. Rudyard Kipling described the river in his story, "The Elephant's Child," as "the great gray-green greasy Limpopo." It is also called the *Crocodile River.* Its last 60 miles (97 kilometers) are tidewater. Above this point, the river varies between a trickle in the dry season and a flood in the wet season. The Olifants River is the Limpopo's main tributary. Hartmut S. Walter

Lin Biao, *leen bee ow* (1907-1971), also spelled *Lin Piao,* was defense minister of China from 1959 to 1971. In the late 1960's and early 1970's, Lin was officially designated to succeed Mao Zedong, chairman of the Chinese Communist Party. But in 1971, Lin disappeared from public view. In 1972, China reported that Lin had died in an airplane crash in Mongolia in 1971. The crash occurred while Lin was reportedly trying to flee China after failing in an attempt to kill Mao and overthrow the government.



Pictorial Parade

Lin Biao

As defense minister, Lin headed the People's Liberation Army. For a time, he headed the Red Guards, a youth group formed in the 1960's to back Mao.

Lin was born in Hubei (or Hupeh) province. A top student under Chiang Kai-shek at the Whampoa Military Academy, Lin joined Mao's Communist forces after graduation. In 1934 and 1935, he led advance troops on the 6,000-mile (9,700-kilometer) *Long March* to escape Chinese Nationalist forces. Lin won victories over invading Japanese forces in the late 1930's and over Nationalist armies in China's civil war. Donald W. Klein

Lin Yutang, *lihn yoo tahng* (1895-1976), was a Chinese scholar and writer. He helped interpret Chinese culture to the West in such books as *My Country and My People* (1935) and *The Importance of Living* (1937). Lin wrote novels, plays, essays, and travel guides in English. His best-known novels are *Moment in Peking* (1939) and *A Leaf in the Storm* (1942). He also translated three Chinese novelettes into the collection *The Widow, Nun, and Courtesan* (1951) and edited *The Wisdom of Confucius* (1938) and *The Wisdom of China and India* (1942).

In 1932, Lin founded the humor magazine *The Analects,* which achieved immediate success. He was interested in Chinese language reform and played a major role in developing a Romanized version of Chinese speech sounds known as *Gwoyeu Romatzyh.* This system of sounds simplified writing in the Chinese language. Lin compiled an important Chinese-English dictionary, published in 1972.

Lin was born in Xiamen (also called Amoy). After serving with the Nationalist government in 1927 and 1928, Lin devoted himself to writing and translating. He lived in the United States from 1936 to 1966 and died in Hong Kong. David R. Knechtges

Lincoln (pop. 78,200) is a city in east-central England. For location, see **England** (political map). The city is the administrative, commercial, and industrial center for the surrounding region. Its industries include engineering, food processing, and the manufacture of such products as cosmetics and plastics. Tourism also contributes to the economy. Lincoln has several medieval buildings, including a castle and a magnificent Gothic cathedral.

In A.D. 47, Roman soldiers established a settlement on the site of what is now Lincoln. During the Middle Ages, the community prospered as a center of the wool export trade. In the mid-1800's, the city began manufacturing agricultural and construction equipment. During the 1900's, a number of light industries were established in Lincoln. G. Malcolm Lewis

Lincoln (pop. 225,581; met. area pop. 250,291) is the capital of Nebraska and the state's second largest city. Only Omaha has more people. Lincoln serves as an important educational center. It is the home of Nebraska Wesleyan University, Southeast Community College, Union College, and the University of Nebraska-Lincoln. Lincoln lies 50 miles (80 kilometers) southwest of Omaha, in eastern Nebraska (see **Nebraska** [political map]).

The state government, the University of Nebraska, Goodyear Tire & Rubber Company, and the Burlington Northern Santa Fe Corporation, a railroad operator, are major employers. Lincoln also has many manufacturing firms. Chief products include automotive belts and hoses, computer software, defense and aerospace equipment, drugs, electrical and laboratory equipment, plastics, and recreational vehicles. Dairy, grain, and meat products are processed in Lincoln. Other industries are commercial printing and insurance.

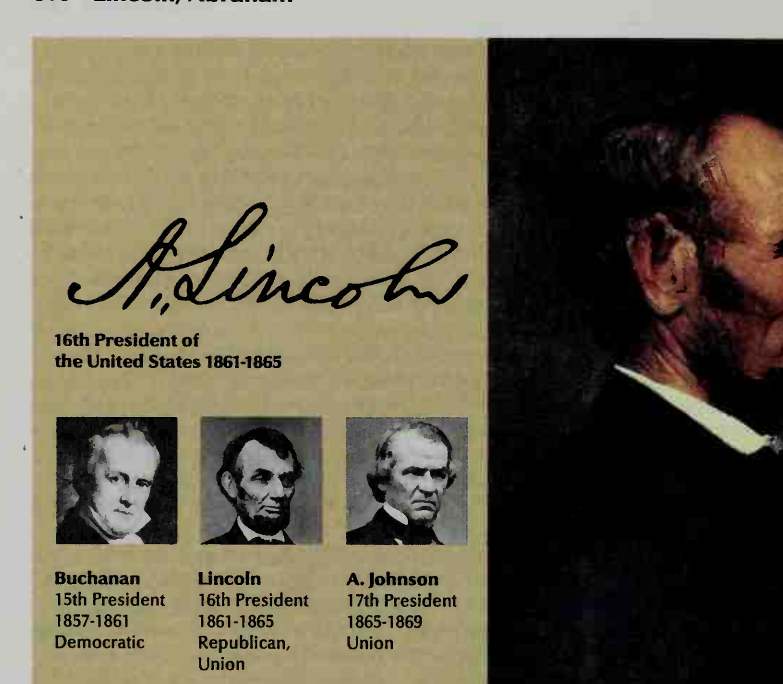
Cultural attractions include the Lied Center for Performing Arts and the University of Nebraska's Sheldon Memorial Art Gallery. The university's State Museum features one of the country's largest collections of prehistoric fossils. The Salt Valley Lakes, a group of lakes and wildlife preserves, are popular recreation areas.

Early settlers were attracted to the area by the salt marshes dotting the prairie. The city was founded in 1859 as Lancaster. In 1867, it was chosen as the capital of Nebraska and renamed Lincoln in honor of President Abraham Lincoln. The state government moved there from Omaha, the former capital, in 1868. Lincoln has a mayor-council form of government. William P. Eddy



Lincoln/Lancaster County Convention & Visitors Bureau

The State Capitol in Lincoln is one of the city's most famous buildings. It was completed in 1932. Free tours are offered daily.

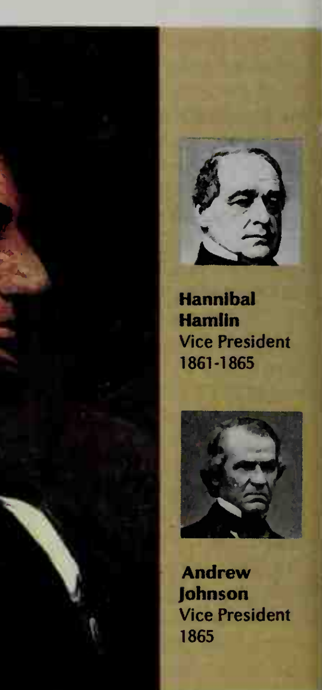


16th President of the United States 1861-1865

Buchanan
15th President
1857-1861
Democratic

Lincoln
16th President
1861-1865
Republican, Union

A. Johnson
17th President
1865-1869
Union



Hannibal Hamlin
Vice President
1861-1865

Andrew Johnson
Vice President
1865

Detail of an oil painting on canvas (1911) by Allen Tupper True; Henry E. Huntington Library and Art Gallery, San Marino, Calif.

Lincoln, Abraham (1809-1865), was one of the truly great men of all time. He led the United States during the Civil War (1861-1865), which was the greatest crisis in U.S. history. Lincoln helped end slavery in the nation and helped keep the American Union from splitting apart during the war. Lincoln thus believed that he proved to the world that democracy can be a lasting form of government. Lincoln's Gettysburg Address, second inaugural address, and many of his other speeches and writings are classic statements of democratic beliefs and goals. In conducting a bitter war, Lincoln never became bitter himself. He showed a nobility of character that has worldwide appeal. Lincoln, a Republican, was the first member of his party to become President. He was assassinated near the end of the Civil War and was succeeded by Vice President Andrew Johnson. Lincoln was the first U.S. President to be assassinated.

The American people knew little about Lincoln when he became President. Little in his past experience indicated that he could successfully deal with the deep differences between Northerners and Southerners over slavery. Lincoln received less than 40 per cent of the popular vote in winning the presidential election of 1860. But by 1865, he had become in the eyes of the world equal in importance to George Washington. Through the years, many people have regarded Lincoln as the greatest person in United States history.

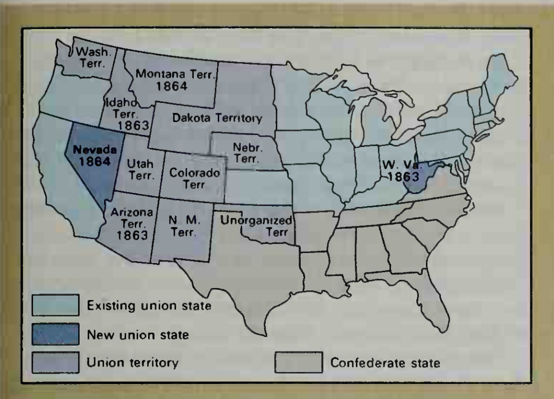
During the Civil War, Lincoln's first task was to win the war. He had to view nearly all other matters in relation to the war. It was "the progress of our arms," he once said, "upon which all else depends." But Lincoln was a peace-loving man who had earlier described military glory as "that attractive rainbow, that rises in showers of blood—that serpent's eye that charms to destroy." The Civil War was by far the bloodiest war in U.S. history. In the Battle of Gettysburg, for example, the more than 45,000 total *casualties* (people killed, wounded, captured, or missing) exceeded the number of casualties in all previous American wars put together.

Lincoln became a remarkable war leader. Some historians believe he was the chief architect of the Union's victorious military strategy. This strategy called for Union armies to advance against the enemy on all fronts at the same time. Lincoln also insisted that the objective of the Union armies should be the destruction of opposing forces, not the conquest of territory. Lincoln changed generals several times because he could not find one who would fight the war the way he wanted it fought. When he finally found such a general, Ulysses S. Grant, Lincoln stood firmly behind him.

Lincoln's second great task was to keep up Northern morale through the horrible war in which many relatives in the North and South fought against one another. He understood that the Union's resources vastly exceeded those of the Confederacy, and that the Union would eventually triumph if it remained dedicated to victory. For this reason, Lincoln used his great writing and speechmaking abilities to spur on his people.

If the Union had been destroyed, the United States could have become two, or possibly more, nations. These nations separately could not have become as prosperous and important as the United States is today. By preserving the Union, Lincoln influenced the course of world history. By ending slavery, he helped assure the moral strength of the United States. His own life story, too, has been important. He rose from humble origin to the nation's highest office. Millions of people regard Lincoln's career as proof that democracy offers all people the best hope of a full and free life.

Life in the United States during Lincoln's Administra-



West Virginia and Nevada joined the Union during Lincoln's first term. Congress created the Arizona and Idaho territories in 1863 and the Montana Territory in 1864.



The United States flag had 35 stars when Lincoln was assassinated in 1865. A star had not yet been added for Nevada, which became the 36th state in 1864.

The world of President Lincoln

The Civil War completely dominated Lincoln's presidency. This tragic conflict resulted in more casualties than any other war in U.S. history. More than 525,000 men died during the four-year conflict, mainly from disease. The total cost to both sides was estimated at $15 billion.
Photographer Mathew Brady provided a striking visual record of the Civil War. He and his assistants took more than 3,500 photographs of battlefields, campsites, people, and events during the war years.
Artist Winslow Homer illustrated Civil War scenes for *Harper's Weekly.* He later became known as one of America's finest painters.
The first federal income tax was enacted by Congress in 1861 to help pay the war costs.
The Kingdom of Italy was proclaimed in 1861, when the Italian states united under Victor Emmanuel II.
The first transcontinental telegraph line was completed in 1861.
Otto von Bismarck became prime minister of Prussia in 1862.
French actress Sarah Bernhardt made her debut in 1862 at the Comédie-Française.
The Homestead Act of 1862 provided settlers with 160 acres of free land, encouraging settlement in the West.
Land-grant universities and colleges were created as a result of the Land-Grant Act, passed by Congress in 1862.
Free mail delivery in large U.S. cities began in 1863.

WORLD BOOK map

Important dates in Lincoln's life

1809	(Feb. 12) Born near present-day Hodgenville, Kentucky.
1834	Elected to the Illinois General Assembly.
1842	(Nov. 4) Married Mary Todd.
1846	Elected to the U.S. House of Representatives.
1858	Debated slavery with Stephen A. Douglas.
1860	(Nov. 6) Elected president of the United States.
1864	(Nov. 8) Reelected president.
1865	(April 14) Shot by John Wilkes Booth.
1865	(April 15) Died in Washington, D.C.

tion revolved around the war. But almost miraculously, the nation also laid out a blueprint for modern America during the war years. Economic development played an important role in Lincoln's vision of America's future, in which all people would have the right to rise in life. National banking legislation provided for paper money as we know it today—and for federal controls to assure sound banking and credit. United States tariffs on European manufactured goods helped limit foreign competition and encouraged the growth of American industry. The administration encouraged labor unions. The government's homestead laws gave free land to settlers. Immigration was encouraged, as was the settlement of the West. Land was also granted for colleges that later became great state universities and for the construction of the nation's first transcontinental railroad. In addition, the nation's first income tax was levied to provide funds for the war.

Soldiers and civilians alike sang "The Battle Hymn of the Republic" or "Dixie." Winslow Homer's painting *Prisoners from the Front* brought him his first fame. Patriotic literature of the time included John Greenleaf Whittier's poem "Barbara Frietchie" and Edward Everett Hale's story "The Man Without a Country." Lincoln and numerous other Americans chuckled at the humorous writings of Artemus Ward and admired the patriotic prints of Currier and Ives.

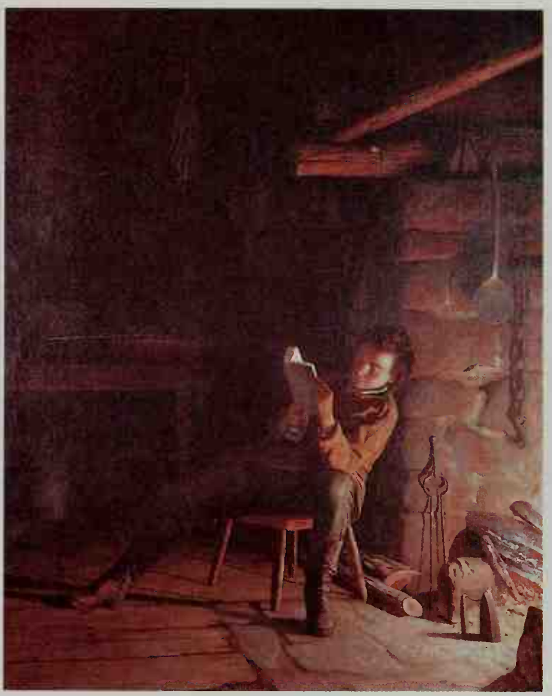
Early life

Family background. Soon after Lincoln was nominated for the presidency, he wrote an autobiography. It began: "Abraham Lincoln was born Feb. 12, 1809, then in Hardin, now in the more recently formed county of Larue, Kentucky. His father, Thomas, & grandfather Abraham, were born in Rockingham county Virginia, whither their ancestors had come from Berks county



Brown Bros.

Lincoln's birthplace was a log cabin near Hodgenville, Kentucky. It probably was a cabin like the one shown here, which stands at the Abraham Lincoln Birthplace National Historic Site.



Boyhood of Lincoln, oil painting on canvas (1868) by Eastman Johnson; University of Michigan Museum of Art, Bequest of Henry C. Lewis

Lincoln read by firelight in the family cabin. Books were rare on the frontier, and he often walked a great distance to borrow one. He had less than a year of formal schooling.

Pennsylvania. His lineage has been traced no farther back than this."

Since Lincoln's time, his ancestry has been traced to a weaver named Samuel Lincoln who emigrated from Hingham, England, to Hingham, Mass., in 1637. Samuel Lincoln founded the Lincoln family in America. The families of several of his children played important parts in Massachusetts history.

Descendants of Mordecai Lincoln, a son of Samuel, moved to New Jersey, Pennsylvania, and Virginia. One was a great-great-grandson named Abraham. This Abraham Lincoln was the grandfather of the future President. He owned a farm in the Shenandoah Valley of Virginia during the Revolutionary War. In 1782, he and his wife and five small children traveled to the wilderness of Kentucky. An Indian killed him there in 1786.

One of his sons, Thomas Lincoln, became the father of the future President. In later years, the President said his father was "a wandering laboring boy, and grew up literally without education." Thomas Lincoln worked as a frontier farm hand during most of his youth. But he learned enough skill at woodworking to earn a living as a carpenter. In 1806, when he was 28 years old, he married Nancy Hanks. Nancy came from what her son described as an "undistinguished" Virginia family of humble, ordinary people. Historians know only that she was the daughter of a Lucy Hanks.

Thomas and Nancy Lincoln lived in Elizabethtown, Ky., for the first 18 months of their marriage. Their first child, Sarah, was born there in 1807. The next year, Thomas Lincoln bought a farm on the South Fork of the Nolin River, about 5 miles (8 kilometers) south of Elizabethtown. Abraham Lincoln was born on this farm.

Boyhood. The Lincolns lived for two years on the farm where Abraham was born. Then they moved to a farm on Knob Creek, 10 miles (16 kilometers) away. When Sarah and Abraham could be spared from their chores, they went to a log schoolhouse. There the children learned reading, writing, and arithmetic.

Many people believe that because Lincoln began his life in a log cabin, he was born in poverty. But many people then lived in log cabins. The Lincolns were as comfortable as most of their neighbors, and Abraham and Sarah were well fed and well clothed for the times. A third child, Thomas, died in infancy.

Thomas Lincoln had trouble over property rights throughout his years in Kentucky. In 1816, he decided to move to Indiana, where people could buy land directly from the government. Besides, Thomas Lincoln did not believe in slavery, and Indiana had no slavery.

The Lincolns loaded their possessions into a wagon. They traveled northward to the Ohio River and were ferried across. Then they traveled through the thick forests to Spencer County, in southwestern Indiana. There, Thomas Lincoln began the task of changing 160 acres (65 hectares) of forest land into a farm.

The Lincolns found life harder in Indiana than in Kentucky. They arrived early in winter, and needed shelter at once. Thomas and his son built a three-sided structure made of logs, called a "half-faced camp." A fire on the fourth side burned night and day. Soon after finishing this shelter, the boy and his father began to build a log cabin. The family moved into it in February 1817.

Bears and other wild animals roamed the forests of this remote region. Trees had to be cut and fields cleared so that a crop could be planted. Although Abraham was only 8, he was large for his age and had enough strength to swing an ax. For as long as he lived in Indiana, he was seldom without his ax. He later called it "that most useful instrument."

Slowly, life became happier on the farm. But in October 1818, Nancy Lincoln died of what the pioneers called "milk sickness." This illness was probably caused by poison in the milk of cows that had eaten snakeroot. Thomas buried his wife among the trees on a hill near the cabin.

Life on the farm became dull and cheerless after the death of Nancy Lincoln. Sarah, now 12, kept house as well as she could for more than a year. Then Thomas Lincoln returned to Kentucky for a visit. While there, on Dec. 2, 1819, he married Sarah Bush Johnston, a widow. He had known her before her first marriage. The new Mrs. Lincoln brought along her three children, aged 12, 8, and 5. Her arrival at the cabin in Indiana ended the long months of loneliness.

Education. Abraham Lincoln grew from a boy of 7 to a man of 21 on the wild Indiana frontier. His education can best be described in his own words:

"There were some schools, so called; but no qualification was ever required of a teacher, beyond *'readin, writin, and cipherin,'* to the Rule of Three. If a straggler supposed to understand latin, happened to sojourn in the neighborhood, he was looked upon as a wizzard. There was absolutely nothing to excite ambition for education. Of course when I came of age I did not know much. Still

somehow, I could read, write, and cipher to the Rule of Three; but that was all."

Lincoln's formal schooling totaled less than a year. Books and paper were scarce on the frontier. Like other boys and girls of his time, Lincoln made his own arithmetic textbook. Several of its pages still exist. Abraham often worked his arithmetic problems on boards, then shaved the boards clean with a drawknife, and used them again and again. He would walk a great distance for a book. The few he could borrow were good ones. They included *Robinson Crusoe, Pilgrim's Progress, and Aesop's Fables.* Lincoln also borrowed a history of the United States and a schoolbook or two.

In 1823, when Abraham was 14, his parents joined the Pigeon Creek Baptist Church. There was bitter rivalry among Baptists, Methodists, Presbyterians, and other denominations. This may help explain why Lincoln never joined any church, and why he never attended church regularly. Yet he became a man of deep religious feelings. He came to know the Bible thoroughly. Biblical references and quotations enriched his later writings and speeches. As President, he kept a Bible on his desk and often opened it for comfort and guidance.

Another book also impressed young Lincoln deeply. He told about it years later in a speech before the New Jersey Senate:

"May I be pardoned if, on this occasion, I mention that away back in my childhood, the earliest days of my being able to read, I got hold of a small book, such a one as few of the younger members have ever seen, Weems' *Life of Washington.* I remember all the accounts there given of the battle fields and struggles for the liberties of the country . . . and you all know, for you have all been boys, how these early impressions last longer than any others. I recollect thinking then, boy even though I was, that there must have been something more than common that those men struggled for."

Youth on the frontier. Abraham reached his full height of 6 feet 4 inches (193 centimeters) long before he was 20. He was thin and awkward, big-boned and strong. The young man developed great strength in his chest and legs, and especially in his arms. He had a homely face and dark skin. His hair was black and coarse, and stood on end.

Even as a boy, Lincoln showed ability as a speaker. He often amused himself and others by imitating some preacher or politician who had spoken in the area. People liked to gather at the general store in the crossroads village of Gentryville. Lincoln's gift for telling stories made him a favorite with the people there. In spite of his youth, he was well known in his neighborhood.

A boy of Lincoln's size and strength had no trouble finding hard work. People always needed great piles of cut wood for cooking and for warmth. He could split logs for fence rails. He could plow fields, cut and husk corn, and thresh wheat with a flail. Lincoln worked for a neighbor when his father could spare him.

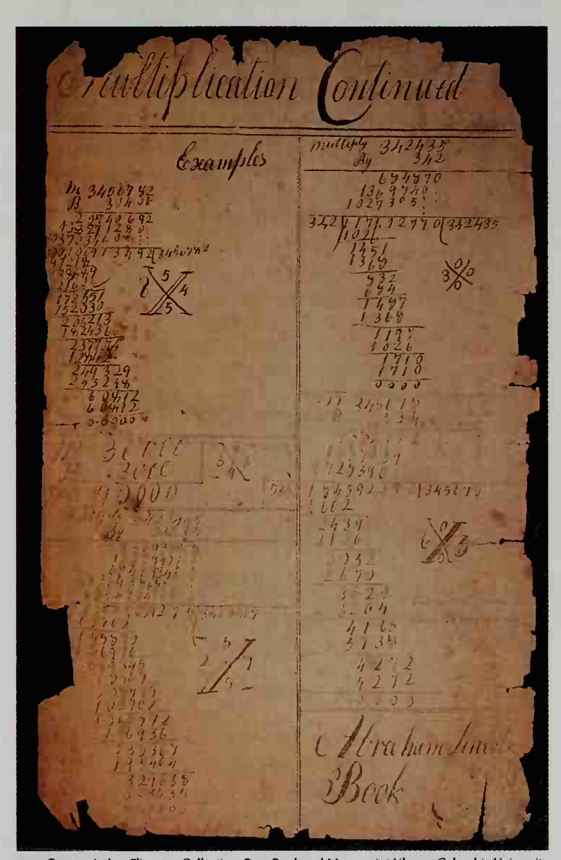
The Ohio River, 15 miles (24 kilometers) away, attracted Lincoln strongly. The first money he earned was for rowing passengers to a steamboat in midstream. In 1828, he helped take a flatboat loaded with farm produce to New Orleans. The trip gave him his first view of the world beyond his own community. That same year, his sister died in childbirth.

In 1830, Thomas Lincoln decided to move again. The years in Indiana had not been successful. The dreaded milk sickness was again striking down settlers. Relatives in Illinois sent word of deep, rich, black soil on the treeless prairies. The Lincolns and several other families started west. They reached their destination two weeks later, and settled 10 miles (16 kilometers) west of Decatur, on the north bank of the Sangamon River.

Lincoln was now 21, and free to strike out for himself. But he remained with his father one more year. He helped plant the first crop, and split rails for a cabin and fences. He worked for neighboring settlers during the winter. In the spring of 1831, a trader named Denton Offutt hired Lincoln and two other young men to take a flatboat to New Orleans. This trip gave Offutt a good impression of his lanky boat hand. He hired Lincoln as a clerk in his new store in the village of New Salem, Ill., 20 miles (32 kilometers) northwest of Springfield. While Lincoln was away, his parents moved to Coles County, where they lived for the rest of their lives.

New Salem years

Life on his own began for Lincoln when he settled in New Salem. He lived there almost six years, from July 1831 until the spring of 1837. The village consisted of log cabins clustered around a mill, a barrelmaker's



George Arthur Plimpton Collection, Rare Book and Manuscript Library, Columbia University

A page from Lincoln's arithmetic textbook shows careful work on a series of multiplication problems. Like many other children of the time, Lincoln made the textbook himself.

shop, a wool-carding machine, and a few general stores.

The villagers helped Lincoln in many ways. The older women mended his clothes, and often gave him meals. Jack Kelso, the village philosopher, introduced him to the writings of the English dramatist William Shakespeare and the Scottish poet Robert Burns. These works, and the Bible, became his favorite reading.

Lincoln arrived in New Salem, as he said, "a piece of floating driftwood." He earned little, and slept in a room at the rear of Offutt's store. Within a few months the business failed. Lincoln would have been out of a job if the Black Hawk War had not begun in 1832.

The Black Hawk War. In 1831, the federal government had moved the Sauk and Fox Indians from Illinois to Iowa. In the spring of 1832, Chief Black Hawk led a band of several hundred Indians back across the Mississippi River to try to regain their lands near Rock Island (see **Black Hawk**). The governor called out the militia, and Lincoln volunteered for service.

Lincoln's company consisted of men from the New Salem area. The men promptly elected him captain. This was only nine months after he had settled in the village. Even after he had been nominated for President, Lincoln said this honor "gave me more pleasure than any I have had since." It provided the first significant indication of his gift for leadership. Lincoln's comrades liked his friendliness, his honesty, and his skill at storytelling. They also admired his great strength and his sportsmanship in wrestling matches and other contests.

Lincoln's term of service ended after 30 days, but he reenlisted, this time as a private. A month later, he enlisted again. He served a total of 90 days, but saw no fighting. He later described his militia experiences as "bloody struggles with the musquetoes" and "charges upon the wild onions."

Search for a career. Before his military service, many of Lincoln's friends had encouraged him to become a candidate for the state legislature. Spurred by their faith, he announced his candidacy in March 1832. The Black Hawk War prevented him from making much of a campaign. He arrived home in July, only two weeks before the election. Lincoln was defeated in the election, but the people in his own precinct gave him 277 of their 300 votes.

Lincoln faced the problem of making a living. He thought of studying law, but decided he could not succeed without a better education. Just then, he had a chance to buy a New Salem store on credit, in partnership with William F. Berry. Lincoln later recalled that the partnership "did nothing but get deeper and deeper in debt." The store failed after a few months.

In May 1833, Lincoln was appointed postmaster of New Salem. Soon afterward, the county surveyor offered to make him a deputy. Lincoln knew nothing about surveying, but he prepared for the work by hard study. Odd jobs and fees from his two public offices earned him a living.

Berry died in 1835, leaving Lincoln liable for the debts of the partnership, about $1,100. It took Lincoln several years to pay these debts, but he finally did it. His integrity helped him earn the nickname "Honest Abe."

In New Salem, Lincoln knew a girl named Ann Rutledge. When she died in the summer of 1835, he grieved deeply. His sorrow gave rise to a belief that he and Ann had planned to be married. Careful study has reduced their supposed love affair to a myth. This conclusion is supported by the fact that Lincoln proposed marriage to a Kentucky girl, Mary Owens, less than 18 months later. He met her while she was visiting her sister in New Salem. The affair was not ardent on either side, and Miss Owens rejected him.

Success in politics. In 1834, Lincoln again ran for the legislature. He had become better known by this time, and won election as a Whig (see **Whig Party**). He served four successive two-year terms in the lower house of the Illinois General Assembly. During his first term, he met a young Democratic legislator, Stephen A. Douglas.

Lincoln quickly came to the front in the legislature. He was witty and ready in debate. His skill in party management enabled him to become the Whig floor leader at the beginning of his second term. He took leading parts in the establishment of the Bank of Illinois and in the adoption of a plan for a system of railroads and canals. This plan broke down after the Panic of 1837. Lincoln also led a successful campaign for moving the state capital from Vandalia to Springfield.

While in the legislature, Lincoln made his first public statement on slavery. In 1837, the legislature passed by an overwhelming majority resolutions condemning abolition societies. These societies urged freedom for slaves. Lincoln and another legislator, Dan Stone, filed a protest. They admitted that Congress had no power to interfere with slavery in the states where it existed. They believed "the promulgation of abolition doctrines tend rather to increase than abate its evils." Their protest arose from the legislature's failure to call slavery an evil practice. Lincoln and Stone declared that "the institution of slavery is founded on both injustice and bad policy." Slavery had become a much greater issue 23 years later, when Lincoln was nominated for President. He said then that his protest in the Illinois legislature still expressed his position on slavery.

Lincoln the lawyer

Study. In 1834, during Lincoln's second campaign for the legislature, John T. Stuart had urged him to study law. Stuart was an attorney in Springfield and a leading member of the legislature. Lincoln overcame his doubts about his education. He borrowed law books from Stuart and studied them. He sometimes walked 20 miles (32 kilometers) from New Salem to Springfield for books. Henry E. Dummer, Stuart's law partner, recalled:

"Sometimes he walked, but generally rode. He was the most uncouth looking young man I ever saw. He seemed to have but little to say; seemed to feel timid, with a tinge of sadness visible in the countenance, but when he did talk all this disappeared for the time and he demonstrated that he was both strong and acute. He surprised us more and more at every visit."

On Sept. 9, 1836, Lincoln received his license to practice law, although his name was not entered on the roll of attorneys until March 1, 1837. The population of New Salem had dropped by that time, and Lincoln decided to move to the new state capital. Carrying all he owned in his saddlebags, he rode into Springfield on April 15, 1837. There he became the junior partner in the law firm of Stuart and Lincoln.

In Lincoln's time, there were few law schools. Most



Library of Congress

Lincoln's law office was in downtown Springfield, Ill., shown here as it looked in 1868. He and his partner worked in a building near the far end of the block in this picture.

lawyers simply "read law" in the office of an attorney. Years later, in giving advice to a law student, Lincoln explained his method of study:

"If you are resolutely determined to make a lawyer of yourself, the thing is more than half done already. It is but a small matter whether you read *with* anybody or not. I did not read with anyone. Get the books, and read and study them till you understand them in their principal features; and that is the main thing. It is of no consequence to be in a large town while you are reading. I read at New Salem, which never had three hundred people living in it. The *books,* and your *capacity* for understanding them, are just the same in all places . . . . Always bear in mind that your own resolution to succeed, is more important than any other one thing."

Early practice. Lincoln's partnership with Stuart lasted until the spring of 1841. Then he became the junior partner of Stephen T. Logan, one of the greatest lawyers who ever practiced in Illinois. This partnership ended in the fall of 1844.

Lincoln then asked William H. Herndon to become his partner. Herndon, nine years younger than Lincoln, had just received his license to practice law. Lincoln called him "Billy," but Herndon always called his partner "Mr. Lincoln." The two men never formally dissolved their law firm. More than 16 years later, Lincoln visited his old office on his last day in Springfield before leaving for Washington to be inaugurated as President. He noticed the firm's signboard at the foot of the steps and said: "Let it hang there undisturbed. Give our clients to understand that the election of a President makes no change in the firm of Lincoln and Herndon."

The practice of law in Illinois was not specialized in Lincoln's time. He tried his first case in the circuit court of Sangamon County. He practiced in the Illinois federal courts within two years after his admission to the bar. A year later, he tried the first of many cases in the state supreme court. But all the while, he also handled cases before justices of the peace. He also gave advice and opinions on many matters for small fees.

Lincoln's family. Soon after Lincoln moved to Springfield, he met Mary Todd (Dec. 13, 1818-July 16, 1882), a woman from Kentucky who lived there with a married sister. They had a stormy courtship and at one time broke their engagement. They were married on Nov. 4, 1842, when Lincoln was 33 and his bride was 23.

Mary Todd Lincoln was high-strung and socially ambitious. Lincoln tended to be moody and absent-minded. Their contrasting personalities sometimes caused friction. But they had a loving marriage that lasted until Abraham's death. See **Lincoln, Mary Todd.**

Lincoln and his bride first lived in a Springfield boardinghouse, where they paid $4 a week. Eighteen months after his marriage, Lincoln bought the plain but comfortable frame house in which the family lived until he became President. By the time he bought the house, his first son, Robert Todd, was 9 months old (see **Lincoln, Robert Todd**). The Lincolns' second son, Edward Baker, was born in 1846, but died four years later. William Wallace, born in 1850, died in the White House at the age of 11. Their fourth son, Thomas, usually called Tad, became ill and died in 1871 at age 18.

The family lived comfortably. Lincoln became a highly successful lawyer and politician, and was not the poverty-stricken failure sometimes portrayed in legend. He often cared for his own horse and milked the family cow, but so did most of his neighbors. The Lincoln family usually employed a servant to help with the housework.

Riding the circuit. The state of Illinois was, and still is, divided into circuits for judicial purposes. Each circuit consisted of several counties where court was held in turn. The judge and many lawyers traveled from county to county. They tried such cases as came their way during each term.

Lincoln "traveled the circuit" for six months each year. He loved this kind of life. The small inns where the lawyers stayed had few comforts, but they offered many opportunities for meeting people. Lively talk and storytelling appealed to Lincoln. He also liked the long rides across the prairies. Lincoln's circuit at its largest included 15 counties, and covered about 8,000 square miles (21,000 square kilometers).

Lincoln developed traits as a lawyer that made him





Granger Collection

Abraham Lincoln and Mary Todd were married in 1842. Mrs. Lincoln was a temperamental woman whose years as first lady were marred by the Civil War. Several of her relatives served in the Confederate Army, and she was constantly suspected of disloyalty to the Union.

well known throughout Illinois. He could argue a case strongly. He sometimes persuaded clients to settle their differences out of court, which meant a smaller fee, or no fee at all, for him. In court, Lincoln could present a case so that 12 jurors, often poorly educated, could not fail to understand it. He could also argue a complicated case before a well-informed judge. He prepared his cases thoroughly, and was unfailingly honest.

National politics

Search for advancement. After four terms in the Illinois legislature, Lincoln wanted an office with greater prestige. He had served the Whig Party well, and election to Congress became his goal.

In 1840, Lincoln made a speaking tour of the state for William Henry Harrison, the Whig candidate for President. He campaigned on the issue of a sound central banking system, speaking out in favor of rechartering the Bank of the United States. Lincoln believed his service had earned him the nomination for Congress from his district. In 1843, and again in 1844, the nomination went to other candidates.

Disappointed, but not bitter, Lincoln worked for the election of Henry Clay, the Whig presidential candidate in 1844. During this campaign, Lincoln focused on the need for a tariff, which would raise the cost of imports and aid American industrial growth. Two years later, Lincoln received his reward and won the Whig nomination for the U.S. House of Representatives. His opponent in the election was Peter Cartwright, a well-known Methodist circuit rider. The Whigs firmly controlled Lincoln's district, and he got 6,340 of the 11,418 votes cast.

Congressman. Lincoln took his seat in Congress on Dec. 6, 1847. By that time, the United States had won the Mexican War, although a peace treaty between Mexico and the United States had not yet been signed. Lincoln joined his fellow Whigs in blaming President James K. Polk for the war. He said of Polk, "The blood of this war, like the blood of Abel, is crying to heaven against him." But he would not abandon U.S. troops on the battlefield and voted to supply them with equipment.

Lincoln failed to make the reputation he had hoped for in Congress. He gave notice that he intended to introduce a bill to free the slaves in the District of Columbia, but he never did. He emphasized his position on slavery by supporting the Wilmot Proviso, which would have banned slavery in any territory acquired from Mexico (see **Wilmot Proviso**).

Throughout his term, Lincoln supported the Whig policy of having the federal government pay for internal improvements. He made several speeches in support of this policy, and once reproved President Polk for vetoing funds to make rivers and harbors more navigable and thus increase commerce. Lincoln worked for the nomination and election of Zachary Taylor, the Whig candidate for President in 1848.

Return to law. Lincoln's term ended on March 4, 1849. He tried unsuccessfully to get an appointment as Commissioner of the General Land Office. The Administration offered to appoint him secretary, then governor, of Oregon Territory. Lincoln refused both offers.

Lincoln returned to Springfield. He practiced law more earnestly than ever before. He continued to travel the circuit, but appeared more often in the higher courts. He also handled more important cases. Corporations and big businesses were becoming increasingly important in Illinois and neighboring states. Lincoln represented them frequently in lawsuits, and soon prospered. The largest fee he ever received, $5,000, was for his successful defense of the Illinois Central Railroad in

an important tax case. After 1849, Lincoln's reputation grew steadily. In the 1850's, he was known as one of the leading lawyers of Illinois.

Reentry into politics. A sudden change in national policy toward slavery brought Lincoln back into the center of political activity in Illinois. The Missouri Compromise of 1820 had prohibited slavery in new territories north of an east-west line that was an extension of Missouri's southern boundary (see **Missouri Compromise**). Early in 1854, Senator Stephen A. Douglas of Illinois introduced a bill to organize the territories of Kansas and Nebraska. As approved by Congress, this Kansas-Nebraska Act repealed the Missouri Compromise. It provided that the settlers of new territories should decide for themselves whether they wanted slavery. See **Kansas-Nebraska Act**.

Lincoln and many others had believed that slavery had been permanently limited and would in time die. Lincoln believed that the new policy gave new life to slavery, and it outraged him.

Lincoln revered the Founding Fathers. He believed they had written a promise of freedom and equality into the Declaration of Independence. He once said: "I have never had a thought politically which did not spring from the sentiments embodied in the Declaration of Independence." During his early years in politics, Lincoln had looked up to Henry Clay as an ideal politician. But he looked to Thomas Jefferson for his democratic political principles and to Alexander Hamilton for his economic principles.

Lincoln always opposed slavery, but he never became an abolitionist. He believed that the bonds holding the nation together would be strained if Americans made a rapid break with the past. Lincoln granted that slavery should have the protection that the Constitution gave it. But he wanted the people to realize that slavery was evil, and should be put on the road to extinction.

Douglas refused to admit that slavery was wrong. He said he did not care whether the people of new territories voted for or against slavery. Lincoln believed that the nation stood for freedom and equality. He felt it must not be indifferent to the unjust treatment of any person. To ignore moral values, he said, "deprives our republican example of its just influence in the world." It enabled the enemies of free institutions "to taunt us as hypocrites." Lincoln resolved to do what he could to reverse the Kansas-Nebraska Act.

A turning point in Lincoln's life came with the rise of the slavery controversy. Fighting against what he termed the "cancer" of bondage, he rose to the presidency and directed a bloody civil war that would put an end to what he saw as an evil institution. But first, many political battles had to be fought.

Lincoln entered the congressional election campaign of 1854 to help a candidate who opposed the Kansas-Nebraska Act. But when Senator Douglas returned to Illinois to justify the new law, Lincoln opposed him wherever he could. At Springfield, Peoria, and Chicago, Lincoln delivered such powerful speeches that he became known as the leader of the Illinois forces opposing the Kansas-Nebraska Act. He was again elected to the Illinois legislature, but resigned in order to run for the United States Senate.

At that time, the legislature elected senators. On the first ballot, Lincoln received 45 votes, which was 5 short of a majority. On each succeeding ballot, his vote dwindled. Finally, to keep a Douglas supporter from being elected, Lincoln persuaded his followers to vote for Lyman Trumbull, who had started with only 5 votes. Trumbull was elected.

The Whig Party began falling apart during the 1850's, largely because party members in various parts of the country could not agree on a solution to the slavery problem. In 1856, Lincoln joined the antislavery Republican Party, then only two years old. During the presidential election campaign that year, he made more than a hundred speeches in behalf of John C. Frémont, the Republican candidate. Frémont lost the election to Democrat James Buchanan. But Lincoln had strengthened his own position in the party through his unselfish work.

The debates with Douglas. In 1858, Lincoln was nominated to run against Douglas for the U.S. Senate. He accepted the honor with a speech that caused severe criticism. Many people thought his remarks stirred up conflict between the North and South. Lincoln said:

"A house divided against itself cannot stand. I believe this government cannot endure, permanently half *slave* and half *free*. I do not expect the Union to be *dissolved*—I do not expect the house to *fall*—but I *do* expect it will cease to be divided. It will become *all* one thing, or *all* the other. Either the *opponents* of slavery will arrest the further spread of it, and place it where the public mind shall rest in the belief that it is in the course of ultimate extinction; or its *advocates* will push it forward till it shall become alike lawful in *all* the States—*old* as well as *new, North* as well as *South*."

After a few speeches, Lincoln challenged Douglas to a series of debates. Douglas accepted, and named seven places for the meetings. The first debate was held at Ottawa, Illinois, on Aug. 21, 1858. The last was at Alton, Illinois, on October 15. Each candidate spoke for an hour and a half. Large crowds attended each debate except the one at Jonesboro, in the southernmost part of the state. Newspapers reported the debates, and the two men drew national attention.

The debates centered on the extension of slavery into free territory. Douglas defended the policy of the Kansas-Nebraska Act. He called this policy *popular sovereignty*. His opponents ridiculed it as *squatter sovereignty* (see **Popular sovereignty**). Lincoln argued that the Supreme Court of the United States, in the Dred Scott Decision, had opened the way for slavery to enter all the territories (see **Dred Scott Decision**). In the debate held at Freeport, Illinois, Douglas denied this argument. He contended that the people of any territory could keep slavery out of that territory simply by refusing to pass local laws protecting it. This position became known as the *Freeport Doctrine*. Lincoln insisted that there was a fundamental difference between Douglas and himself. Douglas ignored the moral question of slavery, but Lincoln regarded slavery "as a moral, social, and political evil."

In addition to the debates, both men spoke almost daily to meetings of their own. Each traveled far and wide. Before the exhausting campaign ended, Douglas's deep bass voice had become so husky that it was hard to understand him. Lincoln's high, penetrating voice still reached the limits of a large audience.

In the election, Lincoln candidates for the legislature received more votes than their opponents. But the state was divided into districts in such a way that Douglas candidates won a majority of the seats. As a result, Douglas was reelected by a vote of 54 to 46.

The debates made Lincoln a national figure. Early in 1860, he delivered an address at Cooper Union in New York City. The speech ended with the famous plea: "Let us have faith that right makes might, and in that faith let us to the end dare to do our duty as we understand it." This address and others delivered later in New England made a strong impression on many influential eastern Republicans.

Election of 1860. The Republican National Convention met in Chicago on May 16, 1860. Lincoln was by no means unknown to the delegates. The week before, at the Illinois state Republican convention, his supporters had nicknamed him "the Railsplitter." This nickname, recalling the days when Lincoln had split rails for fences, helped make him even better known to the delegates. But other party leaders had larger followings. Senator William H. Seward of New York had the strongest support, but he also had many enemies. Senator Salmon P. Chase of Ohio lacked the united support of even his own state. Lincoln had never held a prominent national office, and had no bitter enemies. He held moderate views on the slavery question. His humble background could be counted on to arouse great enthusiasm among the voters.

On the first ballot, Seward received 173$\frac{1}{2}$ votes, Lincoln 102, and Chase 49. Lincoln gained the support of Pennsylvania and Indiana on the second ballot, and received 181 votes to 184$\frac{1}{2}$ for Seward. During the third ballot, Lincoln continued to gain strength. Before the result was announced, Ohio switched four votes from Chase to Lincoln. This gave Lincoln more than the 233 votes needed to win the nomination. The delegates nominated Senator Hannibal Hamlin of Maine for Vice President.

Lincoln's first election

Place of nominating convention	Chicago
Ballot on which nominated	3rd
Northern Democratic opponent	Stephen A. Douglas
Southern Democratic opponent	John C. Breckinridge
Constitutional Union opponent	John Bell
Electoral vote*	180 (Lincoln) to: 72 (Breckinridge) 39 (Bell) 12 (Douglas)
Popular vote	1,865,908 (Lincoln) to: 1,380,202 (Douglas) 848,019 (Breckinridge) 590,901 (Bell)
Age at inauguration	52

*For votes by states, see Electoral College (table).

Like other presidential candidates of his period, Lincoln felt it was undignified to campaign actively. He stayed quietly in Springfield during the election campaign. His followers more than made up for his inactivity. The Democratic Party broke into two factions, which helped Lincoln immensely. Senator Douglas, the nation's leading Democrat, had angered the proslavery wing of his party. Northern Democrats nominated him for President. The Southern faction of the Democratic Party chose Vice President John C. Breckinridge. A fourth party, calling itself the Constitutional Union Party, nominated former Senator John Bell of Tennessee.



Lincoln-Douglas Debate, oil painting on canvas (1918) by Robert Marshall Root; Illinois State Historical Library

The Lincoln-Douglas debates attracted national attention in 1858. Lincoln was running for the U.S. Senate against Stephen A. Douglas, shown seated at Lincoln's right. The two men debated in seven Illinois cities on the issue of extending slavery into free territory.



New York Public Library

"The Railsplitter," Lincoln's nickname, referred to a time when he split logs for fences. This unflattering cartoon of 1860 shows him as a presidential candidate, splitting the Union.



Chicago Historical Society

At his Springfield home, Lincoln held a "front porch rally" during the 1860 campaign. He is shown here standing to the right of the doorway, surrounded by supporters.



Granger Collection

A campaign poster of 1860 shows Lincoln and his running mate, Senator Hannibal Hamlin of Maine. A split in the Democratic Party helped Lincoln win the presidency.

Lincoln won election easily, receiving 180 electoral votes to 72 for Breckinridge, 39 for Bell, and 12 for Douglas. But more Americans voted against Lincoln than for him. The people gave him 1,865,908 votes, compared to a combined total of 2,819,122 for his opponents. All Lincoln's electoral votes, and nearly all his popular votes, came from the North.

Lincoln's Administration (1861-1865)

The South secedes. During the months before Lincoln's inauguration, many Southern leaders threatened to withdraw their states from the Union if Lincoln should win the election. On Dec. 20, 1860, South Carolina passed an Ordinance of Secession that declared the Union dissolved as far as that state was concerned. By the time Lincoln became President, six other Southern States had withdrawn from the Union. Four more states followed later. The seceded states organized themselves into the Confederate States of America. See **Confederate States of America.**

First inauguration. Lincoln said farewell to his Springfield neighbors on Feb. 11, 1861. He parted with these words: "Here I have lived a quarter of a century, and have passed from a young to an old man. Here my children have been born, and one is buried. I now leave, not knowing when, or whether ever, I may return, with a task before me greater than that which rested upon Washington. Without the assistance of that Divine Being who ever attended him, I cannot succeed. With that assistance I cannot fail. Trusting in Him, who can go with me, and remain with you and be everywhere for good, let us confidently hope that all will yet be well. To His care commending you, as I hope in your prayers you will commend me, I bid you an affectionate farewell."

The long train trip to Washington, D.C., had been carefully planned to include stops at most large Eastern cities. This allowed many thousands of people to see the man who would be their next President. In Philadelphia, Lincoln heard a report of an assassination plot. In Harrisburg, Pa., his advisers persuaded him to cut short his trip. Lincoln continued in secret to Washington, arriving early on the morning of February 23.

On March 4, 1861, Lincoln took the oath of office and became the 16th President of the United States. In his inaugural address, Lincoln denied that he had any intention of interfering with slavery in states where the Constitution protected it. He urged the preservation of the Union. Lincoln warned that he would use the full power of the nation to "hold, occupy, and possess" the "property and places" belonging to the federal government. By "property and places," he meant forts, arsenals, and custom houses. Lincoln's closing passage had great beauty and literary power. He appealed to "the mystic chords of memory, stretching from every battlefield and patriot grave to every living heart and hearthstone all over this broad land."

Lincoln announced his Cabinet the day after his inauguration. Two members, William H. Seward and Salmon P. Chase, had been his principal rivals for the presidential nomination. The Cabinet members represented many shades of opinion within the Republican Party. On the whole, they were an exceptionally able group.

Highlights of Lincoln's Administration

1861	(April 12) The Civil War began.
1861	(April 27) Lincoln proclaimed a blockade of Southern ports.
1862	(May 20) Congress approved the Homestead Act.
1862	(July 1) Lincoln signed the Pacific Railroad Act.
1862	(July 2) The Land-Grant Act set aside land for state colleges.
1862	(Sept. 22) Lincoln issued a preliminary proclamation of emancipation.
1863	(Jan. 1) Lincoln issued the Emancipation Proclamation.
1863	(Feb. 25) Lincoln approved the National Bank Act.
1863	(July 1-3) Union armies won the Battle of Gettysburg.
1863	(July 4) Vicksburg, Miss., fell to Union forces.
1863	(Nov. 19) Lincoln delivered the Gettysburg Address.
1864	(Sept. 2) Sherman's army captured Atlanta, Ga.
1864	Lincoln was reelected President.
1865	(April 9) The Civil War ended.

Fort Sumter and war. As the Southern States seceded, they seized most of the federal forts within their boundaries. Lincoln had to decide whether the remaining forts should be strengthened and whether to try to retake the forts already in Southern hands.

Fort Sumter, in Charleston Harbor, became a symbol of an indivisible Union. Major Robert Anderson commanded the Union garrison there. If Lincoln withdrew the troops, a storm of protest would rise in the North. If he reinforced Fort Sumter, the South would consider it an act of war.

As a compromise, Lincoln decided to send only provisions to Anderson, whose supplies were running low. He informed South Carolina of his intention. Leaders of the state regarded the relief expedition as a hostile act, and demanded Anderson's surrender. Anderson refused, and on April 12, General Pierre G. T. Beauregard ordered Confederate artillery to fire on the fort. Anderson surrendered the next day. The attack on Fort Sumter marked the start of the Civil War. See **Civil War.**

Lincoln met the crisis with energetic action. He called out the militia to suppress the "insurrection." He proclaimed a blockade of Southern ports, and expanded the army beyond the limit set by law. Southern sympathizers living in the North were obstructing the war effort. As a result, Lincoln suspended the privilege of *habeas corpus* in areas where these Southern sympathizers were active (see **Habeas corpus**). In addition, Lincoln ordered the spending of federal funds without waiting for congressional appropriations.

Lincoln believed all these actions to be within the war powers granted the President by the Constitution. He justified his acts when Congress met for the first time in his Administration in July 1861. The message Lincoln delivered to Congress ranks as one of his greatest state papers. Chief Justice Roger B. Taney had attacked Lincoln bitterly for suspending habeas corpus. In his message, Lincoln posed a question that even today is difficult to answer: "Are all the laws *but one* to go unexecuted, and the government itself go to pieces lest that one be violated?"

Lincoln felt that the breakup of the American nation would be a tragedy. Not only Americans, but ultimately all people, would suffer. To him, the United States represented an experiment in the people's ability to govern themselves. If it failed, monarchs, dictators, and their supporters could say that people were not capable of ruling themselves, and that someone must rule them. Lincoln regarded the fate of world democracy as the central issue of the Civil War.

Building the army. Two days after Fort Sumter fell, Lincoln called for 75,000 men for the army. The North offered far more volunteers than the government could equip. By July 1861, an army had been assembled near Washington. An equal force of Confederates had taken position across the Potomac River in Virginia.

Many Northerners clamored for action. They believed the Union forces could end the war by defeating the Confederates in one battle. Newspaper headlines blazed with the cry "On to Richmond!" The Administration yielded to these pressures. Lincoln ordered the Northern army forward under General Irvin McDowell. The result was the first Battle of Bull Run on July 21, in which Confederate forces defeated the Union troops. People in the North now realized the war would be a long one.

As commander in chief of the army, Lincoln had to select an officer capable of organizing untrained volunteers into armies and leading them to victory. General George B. McClellan turned out to be a fine organizer. But his Peninsular Campaign of 1862 ended in failure.



Library of Congress

Lincoln rode to his first inauguration in an open carriage with President Buchanan. This drawing shows the presidential procession heading toward the Capitol, *background,* for the inauguration ceremony. The dome of the Capitol was under construction at the time.



Lincoln and General McClellan met at Antietam, Md., in 1862. McClellan's failure to follow up on his victory over the Confederates later led Lincoln to relieve him of his command.

Library of Congress

This campaign had been aimed at capturing Richmond, Va., the Confederate capital. Lincoln relieved McClellan of much of his command. General John Pope was made commander of troops in Virginia. He was defeated in the second Battle of Bull Run (also called Manassas) on August 29-30, 1862, and Lincoln called on McClellan to defend Washington. On September 17, "Little Mac" turned back the army of General Robert E. Lee in the Battle of Antietam. Then McClellan refused to move. In early November, Lincoln removed him for the second time, and put General Ambrose E. Burnside in command. Burnside met defeat in the Battle of Fredericksburg on December 13. His successor, General Joseph Hooker, lost the Battle of Chancellorsville on May 1-4, 1863.

Union forces made some progress only in the valley of the Mississippi River. There, General Ulysses S. Grant in 1862 took Fort Henry on February 6 and Fort Donelson on February 16. In early April, Grant's troops forced a Confederate army to retreat in the Battle of Shiloh, but only after the Union army had suffered enormous losses.

Strengthening the home front. Organization for military success was only one of Lincoln's tasks. He also had to arouse popular support for the Union armies. Different opinions among the people became plain after their first enthusiasm wore off. Many Northerners were willing to fight to preserve the Union, but not to destroy slavery. Other Northerners demanded that the destruction of slavery should be the main goal.

Lincoln realized that the border states would secede if the antislavery extremists had their way. This would mean the loss of Kentucky, Missouri, Delaware, and Maryland. The task of defeating the South would probably be impossible without the support of these states. Besides, the Constitution protected slavery in the states where it existed. Impulsive generals sometimes issued proclamations freeing slaves, but Lincoln overruled them. Lincoln's moderate position helped keep the border states in the Union. Lincoln also managed to keep the support of the majority of Northerners, who favored fighting to preserve the Union over fighting to free the slaves.

Foreign relations. While meeting his other challenges, Lincoln managed to keep a check on foreign policy. In 1861, Secretary of State Seward suggested that the United States could be unified by provoking several European nations to war. The President quietly ignored this proposal.

In November 1861, Captain Charles Wilkes of the U.S. Navy stopped the British ship *Trent* and removed two Confederate commissioners, James M. Mason and John Slidell. The British angrily demanded the release of the two men, and prepared for war to support their demand. However, the United States later freed Mason and Slidell. Thus, Lincoln avoided a war that would have been disastrous to the United States. See **Trent Affair**.

Life in the White House. To Lincoln, the presidency meant fulfillment of the highest ambition that an American citizen could have. The Civil War destroyed any hope he may have had for happiness in the White House. Aside from directing military affairs and stiffening the will of the North, he carried an enormous burden of administrative routine. His office staff was small. He wrote most of his own letters and all his speeches. He made decisions on thousands of political and military appointments. For several hours each week, he saw everyone who chose to call. During all his years in office, Lincoln was away from the capital less than a month.

Lincoln found some relaxation in taking carriage drives, and he enjoyed the theater. He regarded White House receptions and dinners more as duties than as pleasures. Lincoln's frequent visits to army hospitals tore his gentle heart. Late at night, he sometimes found solace by reading works of Shakespeare or the Bible.

Vice Presidents and Cabinet

Vice President	*Hannibal Hamlin
	*Andrew Johnson (1865)
Secretary of state	*William H. Seward
Secretary of the treasury	*Salmon P. Chase
	*William P. Fessenden (1864)
	Hugh McCulloch (1865)
Secretary of war	Simon Cameron
	*Edwin M. Stanton (1862)
Attorney general	Edward Bates
	James Speed (1864)
Postmaster general	Montgomery Blair
	William Dennison (1864)
Secretary of the Navy	*Gideon Welles
Secretary of the interior	Caleb B. Smith
	John P. Usher (1863)

*Has a separate biography in *World Book*.

But his official duties left little time for diversion.

To Mrs. Lincoln, life in the White House was a tragic disappointment. Her youngest brother, three half brothers, and the husbands of two half sisters were serving in the Confederate Army, and she faced constant suspicion of disloyalty. The pressures of everyday life weighed heavily on her high-strung nature. Jealousy and outbursts of temper cost her many friendships.

Two of Lincoln's sons, William Wallace and Thomas, lived in the White House. For nearly a year, "Willie" and "Tad" enlivened the mansion with their laughter and pranks. Willie's death on Feb. 20, 1862, grieved Lincoln deeply. Mrs. Lincoln could not be consoled. Robert Lincoln had been a student at Harvard when his father was elected. He remained there until February 1865, when he was appointed to General Grant's staff as a captain.

The Emancipation Proclamation. By late summer of 1862, Lincoln was convinced that the time had come for a change in policy toward slavery. Several foreign governments sympathized with the South. But they condemned slavery as evil, and thus did not dare support the Confederacy. Freed slaves could serve as Union soldiers. Besides, many Northerners who had been indifferent to slavery now believed that it had to be stamped out. Lincoln decided to issue a proclamation freeing the slaves. He did not ask the advice of his Cabinet, but he did tell the members what he intended to do. On Seward's advice, he withheld the proclamation until a Northern victory created favorable circumstances.

The Battle of Antietam, fought on Sept. 17, 1862, served Lincoln's purpose. He issued a preliminary proclamation five days later. Lincoln declared that all slaves in states, or parts of states, that were in rebellion on Jan. 1, 1863, would be free. He issued the final proclamation on January 1. Lincoln named the states and parts of states in rebellion, and declared that the slaves held there "are, and hence-forward shall be, free." See **Emancipation Proclamation.**

Actually, the proclamation freed no slaves. It applied only to Confederate territory, where federal officers could not enforce it. The proclamation did not affect slavery in the loyal border states. Lincoln repeatedly urged those states to free their slaves, and to pay the owners for their loss. He promised financial help from the federal government for this purpose. The failure of the states to follow his advice was one of his great disappointments.

The Emancipation Proclamation did have a great long-range effect. In the eyes of other nations, it gave a new character to the war. In the North, it gave a high moral purpose to the struggle and paved the way for the Thirteenth Amendment to the Constitution. This amendment, adopted in December 1865, ended slavery in all parts of the United States.

The Gettysburg Address. Union armies won two great victories in 1863. General George G. Meade's Union forces defeated the Confederates under Lee at Gettysburg, Pa., during the first three days of July. On July 4, Vicksburg, Miss., fell to Grant's troops. This city had been the last Confederate stronghold on the Mississippi River. "The Father of Waters again goes unvexed to the sea," Lincoln declared.

On Nov. 19, 1863, ceremonies were held to dedicate a cemetery on the Gettysburg battlefield. The principal speaker was Edward Everett, one of the greatest orators of his day. He spoke for two hours. Lincoln was asked to say a few words, and spoke for about two minutes.

Many writers have said that Lincoln scribbled his speech while traveling on the train to Gettysburg. This is not true. He prepared the address carefully, well in advance of the ceremonies, although he completed the text in Gettysburg. Everett and many others knew at once that Lincoln's ringing declaration that "government of the people, by the people, for the people, shall not perish from the earth" would live as long as democracy itself. For the complete text of the speech, see **Gettysburg Address.**

The victories at Gettysburg and Vicksburg seemed to promise an early peace. But the war went on. In March 1864, Lincoln put Grant in command of all the Union armies. The Army of the Potomac started to march toward Richmond two months later. At the same time, General William T. Sherman began his famous march from Tennessee to Atlanta, and then to the sea.

Election of 1864. Grant met skillful resistance in the South, and suffered thousands of casualties. Many peo-



Granger Collection

The Lincolns had three sons who lived past infancy. Shown *left to right* are William, Robert, and "Tad." Only Robert lived to adulthood, however. William died at age 11, and Tad at age 18.

Quotations from Lincoln

Abraham Lincoln wrote some of the most moving and memorable words in American history. Many of Lincoln's famous quotations are included in the text of this article. The complete text of Lincoln's Gettysburg Address appears in the **Gettysburg Address** article. Following are several additional quotations from speeches and writings of the 16th President.

Fair play is a jewel.
Letter to Simon Cameron, Aug. 10, 1861

I go for all sharing the privileges of the government who assist in bearing its burdens.
Letter to the editor of the *Sangamon Journal*, New Salem, Ill., June 13, 1836

If destruction be our lot we must ourselves be its author and finisher. As a nation of free men we must live through all time, or die by suicide . . . . Towering genius disdains a beaten path. It seeks regions hitherto unexplored.
Speech in Springfield, Ill., Jan. 27, 1838

Moral principle is a looser bond than pecuniary interest.
Speech, October 1856

With public sentiment, nothing can fail; without it, nothing can succeed.
Speech in Ottawa, Ill., July 31, 1858

What constitutes the bulwark of our own liberty and independence? It is not our frowning battlements, our bristling sea coasts, our army and our navy . . . Our reliance is in the love of liberty which God has planted in us. Our defense is in the spirit which prized liberty as the heritage of all men, in all lands everywhere. Destroy this spirit and you have planted the seeds of despotism at your own doors. Familiarize yourselves with the chains of bondage and you prepare your own limbs to wear them. Accustomed to trample on the rights of others, you have lost the genius of your own independence and become the fit subjects of the first cunning tyrant who rises among you.
Speech at Edwardsville, Ill., Sept. 11, 1858

. . . he who would be no slave must consent to have no slave. Those who deny freedom to others deserve it not for themselves, and under a just God, cannot long retain it.
Letter to H. L. Pierce and others, April 6, 1859

Work, work, work, is the main thing.
Letter to John M. Brockman, Sept. 25, 1860

Ballots are the rightful and peaceful successors to bullets.
Message to Congress, July, 1861

The dogmas of the quiet past are inadequate to the stormy present. The occasion is piled high with difficulty, and we must rise with the occasion. As our case is new, so we must think anew and act anew . . . Fellow citizens, we cannot escape history. We . . . will be remembered in spite of ourselves . . . The fiery trial through which we pass will light us down in honor or dishonor to the last generation . . . In giving freedom to the slave, we assure freedom to the free—honorable alike in what we give and what we preserve. We shall nobly save or meanly lose the last, best hope of earth.
State of the Union Message to Congress, Dec. 1, 1862

Property is the fruit of labor—property is desirable—is a positive good in the world. That some should be rich, shows that others may become rich, and hence is just encouragement to industry and enterprise. Let not him who is houseless pull down the house of another, but let him work diligently and build one for himself, thus by example assuring that his own shall be safe from violence when built.
Reply to Workingmen's Association, March 21, 1864

I claim not to have controlled events, but confess plainly that events have controlled me.
Letter to A. G. Hodges, April 4, 1864

I happen temporarily to occupy this big White House. I am a living witness that any one of your children may look to come here as my father's child has.
Speech at the White House, Aug. 22, 1864

I desire so to conduct the affairs of this administration that if at the end, when I come to lay down the reins of power, I have lost every other friend on earth, I shall at least have one friend left, and that friend shall be down inside me.
Reply to the Missouri Committee of Seventy, 1864

We shall sooner have the fowl by hatching the egg than by smashing it.
Speech, April 11, 1865

ple called him "the butcher," and condemned Lincoln for supporting the cigar-smoking commander. In 1864, Republicans and War Democrats—Democrats who supported Lincoln's military policies—formed the Union Party. In June that year, the party nominated Lincoln for President. It selected former Senator Andrew Johnson of Tennessee, a leading War Democrat, for Vice President. The Democrats chose General George B. McClellan as their candidate for President, and Representative George H. Pendleton of Ohio for Vice President. A group called Radical Republicans persuaded General John C. Frémont to run for President, but he withdrew a month before the election.

Lincoln became less popular as the summer wore on. Late in August, he confessed privately that "it seems exceedingly probable that this administration will not be reelected." Then the military trend changed. Rear Admiral David G. Farragut had won the Battle of Mobile Bay on August 5, and Sherman's troops captured Atlanta on September 2. A series of Union victories cleared Confederate forces from the Shenandoah Valley of Virginia. Many discouraged Northerners took heart again.

The Union victories helped Lincoln win reelection. He defeated McClellan by an electoral vote of 212 to 21, and a popular majority of more than 400,000 votes.

Second inauguration. The end of the war was clearly in sight when Lincoln took the oath of office a second time, on March 4, 1865. Grant had besieged Lee's weary troops at Petersburg, Va. The Southern armies were wasting away in Grant's bulldog grip. Sherman left a wide track of destruction as he marched through Georgia and the Carolinas.

As a result, Lincoln could concentrate on reuniting the nation. In his second inaugural address, he explained that the Civil War had to be fought to abolish slavery. It was God's will, he declared, that the North and South together pay the price for slavery. He urged the people to maintain their faith in God's goodness and justice even if the war should continue "until all the wealth

Lincoln's second election

Place of nominating convention	Baltimore
Ballot on which nominated	1st
Democratic opponent	George B. McClellan
Electoral vote*	212 (Lincoln) to 21 (McClellan)
Popular vote	2,218,388 (Lincoln) to 1,812,807 (McClellan)
Age at inauguration	56

*For votes by states, see **Electoral College** (table).



Meserve Collection, Library of Congress

One of Lincoln's last portraits, probably taken in February 1865, shows the effect of the Civil War years on the president.

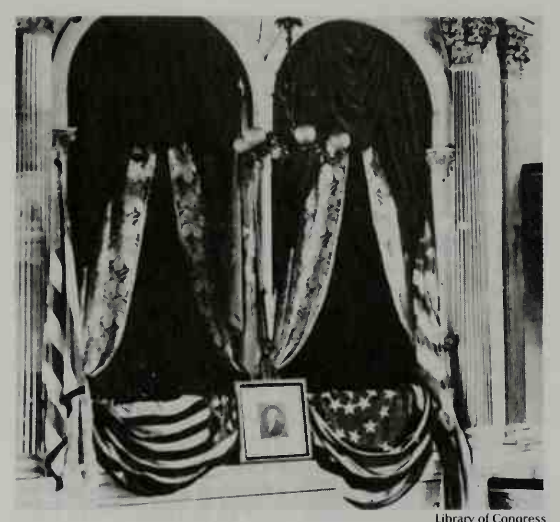


J. Doyle DeWitt Collection, University of Hartford

Mourners lined the streets of New York as Lincoln's funeral procession passed by. A train carried the body most of the way from Washington to Illinois, where Lincoln was buried.

piled by the bondsman's two hundred and fifty years of unrequited toil shall be sunk, and until every drop of blood drawn with the lash shall be paid by another drawn with the sword. ..." He closed with a moving plea for merciful treatment for the South and for all victims of the war.

Photographs taken of Lincoln shortly after his second inauguration show the effect of four years of war. His face had become gaunt and deeply lined. He slept little during crises in the fighting, and his eyes were ringed with black. Lincoln ate his meals irregularly, and had almost no relaxation.



Library of Congress

The President's box at Ford's Theatre in Washington, D.C., was the site of his assassination by John Wilkes Booth. Mathew Brady took this picture the day after the tragic event.

In spite of his exhaustion, Lincoln continued to see widows and soldiers who called at the White House. His delight in rough humor never deserted him. More than once, he shocked members of his Cabinet by reading to them from such humorists as Artemus Ward and Orpheus C. Kerr. Even so, the strain of melancholy that had appeared in him as a young man deepened.

Lincoln came to have a quiet confidence in his own judgment as he met the trials of war. Yet he had no false pride. He was a man of genuine humility. The war brought out his best qualities. He could rise to each new challenge. He was a master politician, and timed his actions to the people's moods. He led men by persuasion. Horace Greeley said: "He slowly won his way to eminence and fame by doing the work that lay next to him —doing it with all his growing might—doing it as well as he could, and learning by his failure, when failure was encountered, how to do it better."

End of the war. On April 9, 1865, Lee surrendered to Grant at Appomattox Court House in Virginia. Under authority from Lincoln, Grant extended generous terms to Lee and his army. A great wave of joy swept the North when the fighting ended.

Lincoln spoke soberly of the future to a crowd that serenaded him on the night of April 11. Louisiana had applied for readmission to the Union under Lincoln's plan of reconstruction. Many Northerners wanted to impose harsher terms on the state. Some complained that blacks would not receive the right to vote under Louisiana's new government. "I would myself prefer," said Lincoln, "that it [the vote] were now conferred on the very intelligent, and on those who serve our cause as soldiers."

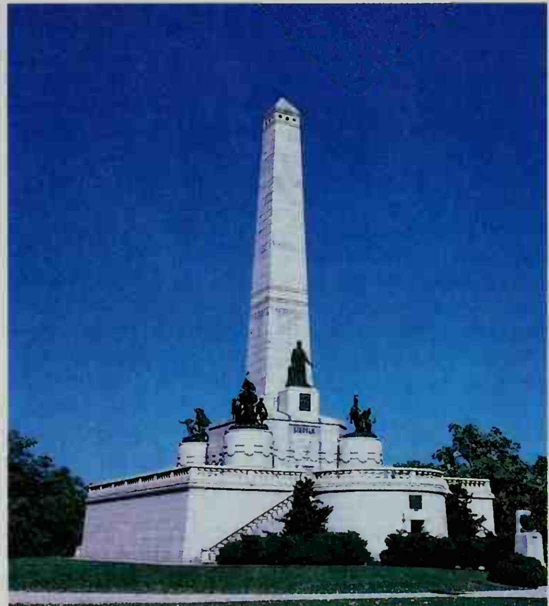
Many people insisted that Lincoln decide if "the seceded states, so called, are in the Union or out of it." No

matter, said the President in his last public address on April 11, 1865, "finding themselves safely at home, it would be utterly immaterial whether they had ever been abroad." Lincoln admitted that the new government of Louisiana was imperfect. But, he asked, "Will it be wiser to take it as it is and help improve it, or to reject and disperse it?"

Assassination. On the evening of April 14, 1865, Lincoln attended a performance of *Our American Cousin* at Ford's Theatre in Washington. A few minutes after 10 o'clock, a shot rang through the crowded house. John Wilkes Booth, one of the best-known actors of the day, had shot the President in the head from the rear of the presidential box. In leaping to the stage, Booth caught his spur in a flag draped in front of the box. He fell and broke his leg. But he limped across the stage brandishing a dagger and crying: "Sic semper tyrannis" (Thus always to tyrants), the motto of Virginia.

Lincoln was carried unconscious to a neighboring house. Lincoln's family and a number of high government officials surrounded him. Lincoln died at 7:22 a.m. on April 15.

As President, Lincoln had been bitterly criticized. After his death, even his enemies praised his kindly spirit and selflessness. Millions of people had called him "Father Abraham." They grieved as they would have grieved at the loss of a father. The train carrying Lincoln's body started west from Washington. Mourners lined the tracks as it moved across the country. Thousands wept as they looked upon his face for the last time. On May 4, Lincoln was buried in Oak Ridge Cemetery in Springfield, Ill. The monument on his grave is a place of universal pilgrimage, as are other spots that his life had touched in Kentucky, Indiana, Illinois, and, above all, in Gettysburg, Pa.



Illinois Department of Conservation

Lincoln's tomb stands at Oak Ridge Cemetery in Springfield, Ill. Around the statue of Lincoln at the center of the tomb are figures representing the artillery, cavalry, infantry, and navy.

The trial of the conspirators. After shooting Lincoln, Booth fled to Maryland on horseback. A friend, David E. Herold, a former druggist's clerk, joined Booth there and helped him escape to Virginia. On April 26, 1865, federal troops searching for Booth trapped the two men in a barn near Port Royal, Va. Herold surrendered, but Booth was killed.

Several people were believed to have been involved with Booth in both Lincoln's assassination and a plot to kill other government officials. Secretary of War Edwin M. Stanton ordered agents of his department to arrest them. Besides Herold, the accused conspirators included George Atzerodt, a carriage maker, for planning the murder of Vice President Andrew Johnson; Lewis Paine, a former Confederate soldier, for attempting to kill Secretary of State William H. Seward; and Mrs. Mary E. Surratt, the owner of a Washington boarding house, for helping the plotters. Booth and the others supposedly planned the crimes in Mrs. Surratt's house.

The Department of War also accused Samuel Arnold and Michael O'Laughlin, boyhood friends of Booth's, of helping him plan the crimes. Samuel A. Mudd, a Maryland physician who had set Booth's broken leg after the assassination of Lincoln, was charged with aiding the plotters. Edward Spangler, a stagehand at Ford's Theatre, was charged with helping Booth escape.

A nine-man military commission tried the accused conspirators in Washington. The trial began on May 10, 1865, and lasted until June 30. The commission convicted all eight defendants and sentenced Atzerodt, Herold, Paine, and Mrs. Surratt to death. They were hanged on July 7. Arnold, Mudd, and O'Laughlin received sentences of life imprisonment, and Spangler received a six-year sentence. O'Laughlin died in prison of yellow fever in 1867. President Johnson pardoned Arnold, Mudd, and Spangler in 1869. Gabor S. Boritt

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Lincoln, Robert Todd
Lincoln Memorial
Lincoln's Birthday
McClellan, George B.
Mount Rushmore National Memorial
Mudd, Samuel A.
National Park System (National historic sites)
Political party
President of the United States
Republican Party
Rutledge, Ann
Sandburg, Carl (His prose)
Slavery
Washington, D.C. (Lincoln Memorial; Ford's Theatre)

Outline

I. Early life
A. Family background
B. Boyhood
C. Education
D. Youth on the frontier

II. New Salem years
A. Life on his own
B. The Black Hawk War
C. Search for a career
D. Success in politics

III. Lincoln the lawyer
A. Study
B. Early practice
C. Lincoln's family
D. Riding the circuit

IV. National politics
A. Search for advancement
B. Congressman

C. Return to law
D. Reentry into politics
E. A turning point
F. The debates with Douglas
G. Election of 1860

V. Lincoln's Administration (1861-1865)

A. The South secedes
B. First inauguration
C. Fort Sumter and war
D. Building the army
E. Strengthening the home front
F. Foreign relations
G. Life in the White House
H. The Emancipation Proclamation
I. The Gettysburg Address
J. Election of 1864
K. Second inauguration
L. End of the war
M. Assassination
N. The trial of the conspirators

Questions

How did Lincoln become involved in the debates with Stephen A. Douglas?
When did Lincoln first express himself on slavery?
What was Lincoln's first political office?
How did Lincoln study for the bar?
What did Lincoln consider to be the central issue of the American Civil War?
How did Lincoln get his early education?
What did Lincoln's second inaugural address show about his intentions toward the South?
What was "circuit riding"? Why did Lincoln enjoy it?
Why did repeal of the Missouri Compromise cause Lincoln to go back into politics?
Why did Lincoln at first deny that the Civil War centered on the issue of slavery? Why did he later change his stand?

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Lincoln, Mary Todd (1818-1882), the wife of President Abraham Lincoln, was the daughter of Robert S. Todd, a banker of Lexington, Kentucky, and his wife, Eliza Parker Todd. In 1839, at the age of 21, she moved to Springfield, Illinois, to live with a married sister. There she met Abraham Lincoln, a young lawyer. They were married on Nov. 4, 1842.

Mary Lincoln achieved her greatest ambition when her husband was elected president. However, her four years as first lady brought sorrow rather than happiness. Numerous people unjustly suspected Mrs. Lincoln of disloyalty to the Union because she came from the South. In addition, Mrs. Lincoln's haughty manner made her unpopular among the wives of government officials.

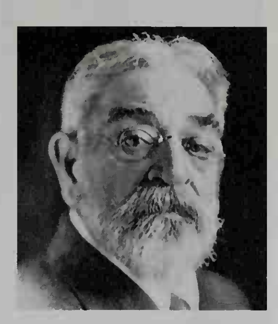
The death of the Lincolns' third son, William Wallace, in 1862 caused her deep grief. In 1865, the shock of the assassination of Lincoln left her both a mental and a physical wreck.

Years of travel failed to restore Mrs. Lincoln's health, which was further weakened in 1871 by the death of another son, Thomas. Her mental depression deepened until her oldest son, Robert, committed her to a private sanitarium in 1875. Mrs. Lincoln was released later that year.

Mrs. Lincoln died on July 16, 1882, in the Springfield home of her sister. She was buried in the Lincoln Tomb in Springfield. Mark E. Neely, Jr.

See also **Lincoln, Abraham** (Lincoln's family; Life in the White House; picture).

Lincoln, Robert Todd (1843-1926), the oldest son of President Abraham Lincoln, became a well-known statesman and lawyer. In 1881, President James A. Garfield named Lincoln secretary of war. Lincoln held the same post under President Chester A. Arthur. From 1889 to 1893, he served as minister to Britain. Lincoln then became associated with the Pullman Company and served as president of the firm from 1897 to 1911.



Robert T. Lincoln

Lincoln was born in Springfield, Illinois. He studied at Harvard College and Harvard Law School. Lincoln served in the Union Army. After the American Civil War, he practiced law.

Mark E. Neely, Jr.

See also **Lincoln, Abraham** (Lincoln's family).

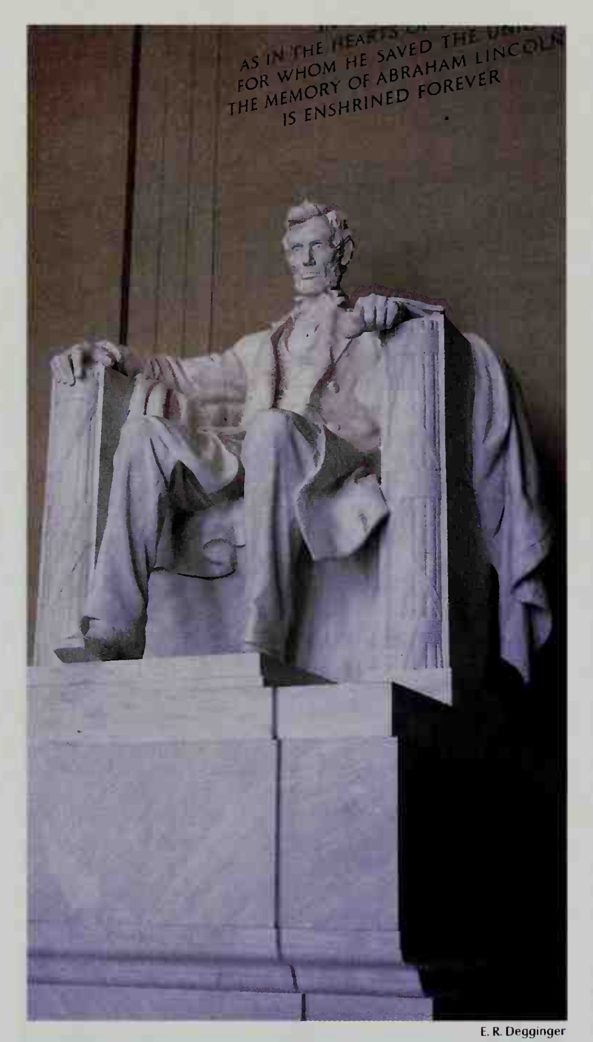
Lincoln Center for the Performing Arts, in New York City, is the home for some of the most important cultural activities in the United States. The center's seven buildings house the Metropolitan Opera, the New York Philharmonic, the Juilliard School, the New York City Ballet, the New York City Opera, the Film Society of Lincoln Center, the Chamber Music Society of Lincoln Center, the Lincoln Center Theatre, the School of American Ballet, Jazz at Lincoln Center, and two branches of the New York Public Library.

Avery Fisher Hall opened in 1962, the New York State Theater in 1964, the Library and Vivian Beaumont Theater in 1965, the Metropolitan Opera House in 1966, the Juilliard School and Alice Tully Hall in 1969, and the Samuel B. and David Rose building in 1990. Each of Lincoln Center's constituent members is financially and artistically independent. Each group is represented on the Lincoln Center Council.

Critically reviewed by the Lincoln Center for the Performing Arts

See also **New York City** (picture).

Lincoln Highway stretches 3,385 miles (5,448 kilometers) between New York City and San Francisco. It is sometimes called the *Main Street of the United States.* In 1912, Carl G. Fisher, an automobile manufacturer, had the idea that a coast-to-coast highway should be built. The automobile industry raised money for the highway, and construction began in 1914. After a national system of route numbers was adopted in 1926, most of what had been completed on the Lincoln Highway was designated U.S. 30. Bruce E. Seely



E. R. Degginger

Lincoln Memorial is a beautiful monument in Washington, D.C., that honors Abraham Lincoln. It stands at the end of the National Mall and ranks as one of the most handsome memorials of the 1900's.

The massive marble building is 80 feet (24 meters) tall, 189 feet (58 meters) long, and 118 $\frac{2}{3}$ feet (36.2 meters) wide. It has a great hall surrounded by 36 Doric columns, which stand for the 36 states in the Union at the time of Lincoln's death. The outside decorations show the names of the 48 states that existed when the building was dedicated, and the 36 states existing when Lincoln died. The hall has three sections. In the center section, which is open in front, sits a gigantic statue of Lincoln by Daniel Chester French. The statue is 19 feet (5.8 meters) tall. The side sections of the hall have tablets with the Gettysburg Address and the Second Inaugural Address, and two wall paintings by Jules Guerin. The paintings are titled *Emancipation* and *Reunion.*

The building stands on a high terrace that is reached by an imposing flight of steps. In front lies a long pool. The Potomac River can be seen from one side. The other side presents a view of the Washington Monument.

A national Lincoln memorial had been urged since 1867, but not until 1911 did Congress pass the law creating a Lincoln Memorial Commission. This commission chose the design by Henry Bacon and the site for the building. The cornerstone was laid on Feb. 12, 1915. The building was dedicated on May 30, 1922. Chief Justice William Howard Taft, as chairman of the commission, presented the memorial to President Warren G. Harding, who accepted it for the United States. Some criticized the design of the building. But it has been accepted as an expression of American ideals, and has inspired millions of visitors to Washington, D.C.

Critically reviewed by National Capital Region, National Park Service

See also **Washington, D.C.** (picture).

A huge statue of Lincoln, *left,* dominates the interior of the Lincoln Memorial, *below.* The beautiful white marble building, dedicated in 1922, resembles the Parthenon in Greece.

Artstreet



Lincoln Park, Michigan (pop. 40,008), is a residential city in the southwestern part of the Detroit metropolitan area (see **Michigan** [political map]). Many of its workers are employed in nearby auto and steel factories. The area is noted as the place where Pontiac, a chief of the Ottawa tribe, held a meeting to plan an attack on Detroit in 1763. Incorporated in 1925, Lincoln Park has a mayor-council government. Peter Gavrilovich

Lincoln Tunnel is a tunnel for motor traffic under the Hudson River. It joins midtown New York City with Weehawken, New Jersey. The tunnel has three tubes, each with two traffic lanes. The 8,216-foot (2,504-meter) center tube, opened in 1937, carries vehicles in either or both directions, depending on traffic needs. Westbound vehicles travel in the 7,482-foot (2,281-meter) north tube, opened in 1945. The 8,006-foot (2,440-meter) south tube is for eastbound traffic.

The completion of the south tube of the Lincoln Tunnel in 1957 brought the total cost to about $190 million. About 30 $\frac{1}{2}$ million vehicles use the tunnel every year.

Boyd C. Paulson, Jr.

See also **Hudson River tunnels** (The Lincoln Tunnel).

Lincoln University was the first institution in the United States chartered to provide higher education for blacks. It is in Lincoln University, Pennsylvania, about 45



Lincoln University

Lincoln University's campus is in Lincoln University, Pennsylvania. The school, which opened in 1854, was the first institution in the United States to provide higher education for blacks.

miles (72 kilometers) southwest of Philadelphia. The school opened in 1854 as the Ashmun Institute. It was renamed Lincoln University in 1866 and has admitted students of all races since then.

Lincoln is coeducational and part of the state system of higher education. The university has divisions of humanities, natural sciences and mathematics, and social science. It grants bachelor's and master's degrees.

Critically reviewed by Lincoln University

Lincoln's Birthday is a legal holiday in about 30 states of the United States. It honors Abraham Lincoln, the 16th president, who was born on Feb. 12, 1809. Most of the states that celebrate Lincoln's Birthday do so on February 12, but a few celebrate it on the first or third Monday of February.

The first observance of his birthday anniversary occurred in 1866, the year following his assassination. At that time, the president, his Cabinet, members of Congress, and representatives of the armed forces and the diplomatic corps met in his honor.

The Republican Club of New York City has held a dinner on February 12 each year since 1887. The cornerstone of the Lincoln Memorial in Washington, D.C., was laid on Feb. 12, 1915. Congress established a Lincoln Sesquicentennial Commission that coordinated activities for the nationwide celebration of Lincoln's 150th birthday anniversary in 1959. Jack Santino

See also **Lincoln, Abraham; Presidents' Day.**

Lind, Jenny (1820-1887), a Swedish soprano, became one of the most famous singers of the 1800's. She had a brilliant career in opera and on the concert stage. Her sweet and flexible coloratura voice and her remarkable vocal control were widely praised, and won for her the



Granger Collection

Jenny Lind, *right,* a Swedish singer, made a concert tour of the United States from 1850 to 1852. The famous American showman P. T. Barnum, *center,* managed part of the tour.

title *Swedish Nightingale* from an adoring public.

Lind was born in Stockholm. She made her debut in 1838 as Agathe in *Der Freischütz.* Three years later she went to Paris to study, and then traveled to Dresden, Germany, to perfect her knowledge of the German language.

After 1849, Lind gave up her career as an opera singer. From 1850 to 1852, she toured the United States, part of the time under the management of the American showman P. T. Barnum (see **Barnum, P. T.**).

Martin Bernheimer

Lindbergh, Anne Morrow (1906-2001), was an American poet and essayist. Her husband was the famous American aviator Charles A. Lindbergh. Their courtship in the late 1920's gained international attention. In the 1930's, the sensational press coverage of the kidnapping and murder of the couple's infant son resulted in their moving to Europe.

Anne Morrow Lindbergh is perhaps best known for two books. One is *Gift from the Sea* (1955), a collection of eight essays about the meaning of a woman's life. The other is *The Unicorn and Other Poems, 1935-1955* (1956). Some critics attacked this work as sentimental, but others defended it as sensitive and deeply felt.

Anne Morrow was born in Englewood, New Jersey, on June 22, 1906. Her father, Dwight W. Morrow, was a famous American diplomat. She became a licensed pilot and made many long flights with her husband. These trips furnished material for two books, *North to the Orient* (1935) and *Listen! The Wind* (1938). Her other writings include *Dearly Beloved* (1962), *Earth Shine* (1969), *Bring Me a Unicorn* (1972), *Hour of Gold, Hour of Lead* (1973), *Locked Rooms and Open Doors* (1974), *The Flower and the Nettle* (1976), and *War Within and Without* (1980). She died on Feb. 7, 2001. Barbara M. Perkins

See also Lindbergh, Charles A.

Lindbergh, Charles Augustus (1902-1974), an American aviator and airmail pilot, made the first solo nonstop flight across the Atlantic Ocean on May 20-21, 1927. Other pilots had crossed the Atlantic before him. But Lindbergh was the first to do it alone nonstop.

Lindbergh's feat gained him immediate, international fame. The press named him "Lucky Lindy" and the "Lone Eagle." Americans and Europeans idolized the shy, slim young man and showered him with honors.

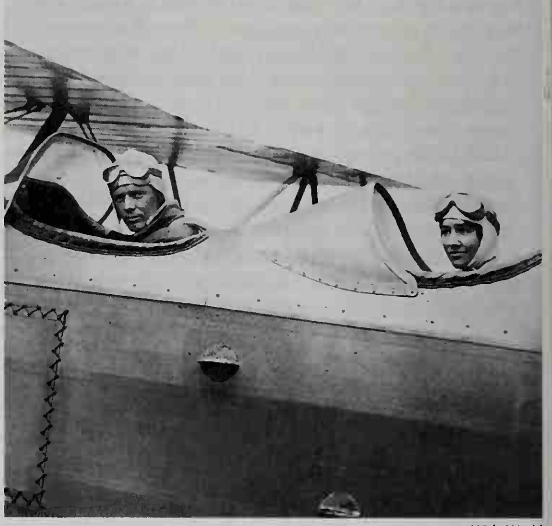
Before Japan attacked Pearl Harbor in 1941, Lindbergh campaigned against voluntary American involvement in World War II. Many Americans criticized him for his noninvolvement beliefs. After the war, he avoided publicity until the late 1960's, when he spoke out for the conservation of natural resources. Lindbergh served as an adviser in the aviation industry from the days of wood and wire airplanes to supersonic jets.

Early life. Charles Augustus Lindbergh was born on Feb. 4, 1902, in Detroit. He grew up on a farm near Little Falls, Minnesota. He was the son of Charles August Lindbergh, a lawyer, and his wife, Evangeline Lodge Land. Lindbergh's father served as a U.S. congressman from Minnesota from 1907 to 1917.

In childhood, Lindbergh showed exceptional mechanical ability. At the age of 18, he entered the University of Wisconsin to study engineering. But Lindbergh was more interested in the field of aviation than he was in school. After two years, he left school to become a *barnstormer,* a pilot who performed daredevil stunts at fairs.

In 1924, Lindbergh enlisted in the United States Army so that he could be trained as an Army Air Service Reserve pilot. In 1925, he graduated from the Army's flight-training school at Brooks and Kelly fields, near San Antonio, as the best pilot in his class. After Lindbergh completed his Army training, the Robertson Aircraft Corporation of St. Louis hired him to fly the mail between St. Louis and Chicago. He gained a reputation as a cautious and capable pilot.

His historic flight. In 1919, a New York City hotel owner named Raymond Orteig offered $25,000 to the first aviator to fly nonstop from New York to Paris. Several pilots were killed or injured while competing for the Orteig prize. By 1927, it had still not been won. Lindbergh believed he could win it if he had the right airplane. He persuaded nine St. Louis businessmen to help him finance the cost of a plane. Lindbergh approached a number of major aircraft manufacturers, but they all refused to sell him a plane. He then selected the Ryan Aeronautical Company of San Diego to manufacture a special plane, which he helped design. He named the plane the *Spirit of St. Louis.* On May 10-11, 1927, Lindbergh tested the plane by flying from San Diego to New York City, with an overnight stop in St. Louis. The flight took 20 hours 21 minutes, a transcontinental record.



Wide World

Charles A. Lindbergh and Anne Morrow Lindbergh flew throughout the world charting new routes for airlines. The aviator taught his wife to fly following their marriage in 1929.

On May 20, Lindbergh took off in the *Spirit of St. Louis* from Roosevelt Field, near New York City, at 7:52 a.m. He landed at Le Bourget Field, near Paris, on May 21 at 10:21 p.m. Paris time (5:21 p.m. New York time). Thousands of cheering people had gathered to meet him. He had flown more than 3,600 miles (5,790 kilometers) in 33 $\frac{1}{2}$ hours.

Lindbergh's heroic flight thrilled people throughout the world. He was honored with awards, celebrations, and parades. President Calvin Coolidge gave Lindbergh the Distinguished Flying Cross. By act of Congress, he was awarded the Medal of Honor.

In 1927, Lindbergh wrote *We,* an autobiography. That same year, he flew throughout the United States to encourage air-mindedness on behalf of the Daniel Guggenheim Fund for the Promotion of Aeronautics. He learned about the pioneer rocket research of Robert H. Goddard, a Clark University physics professor. Lindbergh persuaded the Guggenheim family to support Goddard's experiments, which later led to the development of missiles, satellites, and space travel. Lindbergh also worked for several airlines as a technical adviser.

Good-will ambassador. At the request of the U.S. government, Lindbergh flew to various Latin American countries in December 1927 as a symbol of American good will. While in Mexico, he met Anne Spencer Morrow, the daughter of Dwight W. Morrow, the American ambassador. Lindbergh married Anne Morrow in 1929. He taught her to fly, and they went on many flying expeditions together throughout the world, charting new

routes for various airlines. Anne Morrow Lindbergh also became famous for her poetry and other writings. See **Lindbergh, Anne Morrow.**

Lindbergh invented an "artificial heart" between 1931 and 1935. He developed it for Alexis Carrel, a French surgeon and biologist whose research included experiments in keeping organs alive outside the body. Lindbergh's device could pump the substances necessary for life throughout the tissues of an organ.

The Lindbergh kidnapping. On March 1, 1932, the Lindberghs' 20-month-old son, Charles Augustus, Jr., was kidnapped from the family home in New Jersey. About 10 weeks later, his body was found. In 1934, police arrested a carpenter, Bruno Richard Hauptmann, and charged him with the murder. Hauptmann was convicted of the crime. He was executed in 1936.

The press sensationalized the tragedy. Reporters, photographers, and curious onlookers harassed the Lindbergh family constantly. In 1935, following the Hauptmann trial, Lindbergh, his wife, and their 3-year-old son, Jon, moved to Europe in search of privacy and safety.

The Lindbergh kidnapping led Congress to pass the "Lindbergh law." This law makes kidnapping a federal offense if the victim is taken across state lines or if the mail service is used for ransom demands.

World War II. While in Europe, Lindbergh was invited by the governments of France and Germany to tour the aircraft industries of their countries. Lindbergh was especially impressed with the highly advanced aircraft industry of Nazi Germany. In 1938, Hermann Goering, a high Nazi official, presented Lindbergh with a German medal of honor. Lindbergh's acceptance of the medal caused an outcry in the United States among critics of Nazism.

Lindbergh and his family returned to the United States in 1939. In 1941, he joined the America First Committee, an organization that opposed voluntary American entry into World War II. Lindbergh became a leading spokesman for the committee. He criticized President Franklin D. Roosevelt's foreign policies. He also charged that British, Jewish, and pro-Roosevelt groups were leading America into war. Lindbergh resigned his commission in the Army Air Corps after Roosevelt publicly denounced him. Some Americans accused Lindbergh of being a Nazi sympathizer because he refused to return the medal he had accepted from Goering.

After the Japanese attacked Pearl Harbor on Dec. 7, 1941, Lindbergh stopped his noninvolvement activity. He tried to reenlist, but his request was refused. He then served as a technical adviser and test pilot for the Ford Motor Company and United Aircraft Corporation (now United Technologies Corporation).

In April 1944, Lindbergh went to the Pacific war area as an adviser to the United States Army and Navy. Although he was a civilian, he flew about 50 combat missions. Lindbergh also developed cruise control techniques that increased the capabilities of American fighter planes.

After the war, Lindbergh withdrew from public attention. He worked as a consultant to the chief of staff of the U.S. Air Force. President Dwight D. Eisenhower restored Lindbergh's commission and appointed him a brigadier general in the Air Force in 1954. Pan American World Airways also hired Lindbergh as a consultant. He advised the airline on its purchase of jet transports and eventually helped design the Boeing 747 jet. In 1953, Lindbergh completed *The Spirit of St. Louis,* an expanded account of his 1927 transatlantic flight. The book won a Pulitzer Prize in 1954.



Culver

The "Lone Eagle," as Lindbergh was called, made the first solo nonstop flight across the Atlantic Ocean. His historic journey in 1927 in the *Spirit of St. Louis* took 33 $\frac{1}{2}$ hours and covered more than 3,600 miles (5,790 kilometers).

Lindbergh traveled widely and developed an interest in the cultures of peoples in Africa and the Philippines. During the late 1960's, Lindbergh ended his years of silence to speak out for the conservation movement. He especially campaigned for the protection of humpback and blue whales, two species of whales in danger of becoming extinct. Lindbergh opposed the development of supersonic transport planes because he feared the effects the planes might have on the atmosphere of the earth.

Lindbergh died of cancer on Aug. 26, 1974, in his home on the Hawaiian island of Maui. The *Autobiography of Values,* a collection of Lindbergh's writings, was published in 1978. Ronald J. Ferrara

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Linden is any of a group of graceful shade trees that grow in many parts of the Northern Hemisphere. Lindens are also called *lime trees, linns, bee trees,* and *basswoods.* There are about 35 species of lindens. Three species are native to eastern North America. The *American linden,* the most common North American species, grows up to 120 feet (37 meters) high and can live for more than 100 years.

In June and July, lindens produce clusters of small, fragrant, white or yellow flowers. Berrylike seeds fall from the trees in September and October. Lindens grow best in deep, moist soil, but they can survive in dry areas. They are hardy trees, affected by few serious plant diseases. Lindens also suffer little damage from air pollution and thus can thrive in cities.

Lindens are widely planted as ornamental trees. Popular ornamental varieties include the *large-leaf linden* and the *little-leaf linden,* both native to Europe. The light, soft wood of lindens is used by woodcarvers and in making furniture and toys. American Indians once made rope from the tough inner bark of the linden.

Richard C. Schlesinger

Scientific classification. Lindens belong to the family Tiliaceae. The scientific name for the American linden is *Tilia americana.* The large-leaf linden is *T. platyphyllos,* and the little-leaf linden is *T. cordata.*



© D. Lecourt, Jacana

The linden is an attractive shade tree that has dense foliage. The tree is known for its symmetrical outline.

Lindner, Richard (1901-1978), was a German-born American painter. Lindner painted strongly outlined and boldly colored stylized figures that show the influence of the French artist Fernand Léger. Lindner's works depict the darker aspects he saw in entertainment and street life. Many of these pictures have surrealistic and sexual overtones. In focusing on scenes from everyday life in simplified compositions, Lindner is considered a forerunner and then a strong advocate of Pop Art. Pop Art was an art movement of the 1950's and 1960's based on everyday objects from popular culture, such as comic strips and soft drink bottles. Lindner's work is one of the few connections between the European and the



Disneyland (1965), an oil painting on canvas; Museum Ludwig, Cologne, Germany (© Rheinisches Bildarchiv)

A Richard Lindner painting shows the bold colors and strong outlines typical of the artist's style. The painting is one of many Lindner works that focuses on a single powerful female figure.

American branches of that style. See **Pop art**.

Lindner was born in Hamburg, Germany. He studied art and worked as art director in a publishing house. In 1933, he left Germany to avoid the Nazis and moved to Paris. In 1939, he was imprisoned as a German alien. He later served briefly in the French army. Lindner moved to the United States in March 1941 and became a successful book and magazine illustrator. In 1950, he began to devote himself to painting full-time. Deborah Leveton

Lindsay, Howard (1889-1968), was an American playwright best known for the many plays and stories for musical comedies he wrote with Russel Crouse. They won the 1946 Pulitzer Prize in drama for their political satire *State of the Union* (1945). They collaborated on the comedy *Life with Father* (1939), the longest running nonmusical play in American theater history. Lindsay starred in it with his wife, Dorothy Stickney. Lindsay and Crouse wrote the books for such musicals as *Call Me Madam* (1950) and *The Sound of Music* (1959). Lindsay was born in Waterford, New York. Frederick C. Wilkins

Lindsay, John Vliet (1921-2000), served as mayor of New York City from 1966 through 1973. In 1965, he scored an upset victory in the heavily Democratic city by defeating the Democratic and Conservative party candidates as the nominee of the Republican and Liberal parties. Lindsay's first term was marked by unrest and strikes in New York City's schools, transit system, and other public services. In 1969, Lindsay was defeated for renomination in the Republican primary election. However, he ran as the candidate of the Liberal and Independent parties, and he was reelected mayor.

Lindsay was born in New York City and graduated from Yale University and the Yale Law School. From 1955 to 1957, he served as executive assistant to the U.S. attorney general. In 1958, he won the first of four terms in the U.S. House of Representatives, where he strongly supported civil rights legislation. In 1964, he refused to support conservative Senator Barry M. Goldwater, the Republican presidential nominee. In 1967, President Lyndon B. Johnson appointed Lindsay vice chairman of the National Advisory Commission on Civil Disorders (Kerner Commission). The committee studied the causes of the riots in U.S. cities during the mid-1960's.

In August 1971, Lindsay changed his party affiliation from Republican to Democrat. He was a candidate for the 1972 Democratic presidential nomination but withdrew when he failed to gain support in the primaries. David S. Broder

Lindsay, Vachel (1879-1931), was an American poet. He believed that poetry should be performed rather than simply read. Some of his poems, such as "The Congo" (1914), even include stage directions. Among his other effective stage pieces were "General William Booth Enters into Heaven" (1913) and "The Ghosts of the Buffaloes" (1917).



Chicago Daily News

Vachel Lindsay

Lindsay often took long walking tours through the countryside. He read aloud from his works in exchange for food and shelter.

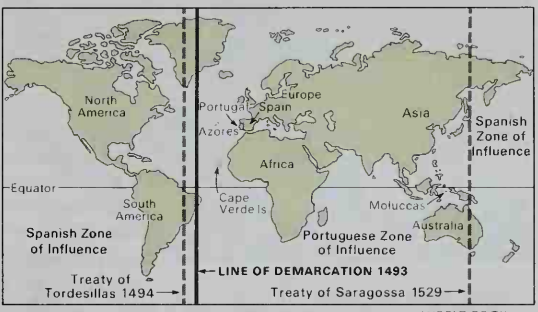
Lindsay's poems feature strong rhythms and vivid images. He often wrote about baseball players, circus performers, politicians, and movie stars. Much of his work shows his love of nature and democracy. But he also criticized the selfishness and emphasis on worldly things that he saw in America. His critical poems include "The Eagle That Is Forgotten" (1913) and "Abraham Lincoln Walks at Midnight" (1914). Nicholas Vachel Lindsay was born in Springfield, Ill. William Harmon

Line Islands, also called the Equatorial Islands, consist of 11 isolated, low coral islands in the central Pacific Ocean. The Line Islands lie on both sides of the equator. They have an area of 222 square miles (576 square kilometers). For the location of the islands, see **Kiribati** (map). Three of the Line Islands—Jarvis, Kingman Reef, and Palmyra—are possessions of the United States. The eight other islands are part of Kiribati. They are Caroline, Flint, Kiritimati (also called Christmas Island), Malden, Starbuck, Tabuaeran (Fanning), Teraina (Washington), and Vostok. Kiribati is an island nation that also includes Banaba, the Gilbert Islands, and the Phoenix Islands. See also **Kiritimati Atoll**. Robert C. Kiste

Line of Demarcation was an imaginary line drawn by Pope Alexander VI to settle land claims. The line was drawn in 1493, after Christopher Columbus returned from his first voyage to the Americas. The pope hoped it would prevent disputes between Spain and Portugal over new lands discovered by Spanish and Portuguese explorers. The line ran from north to south about 350 miles (563 kilometers) west of the Azores and Cape Verde Islands. It barely touched the east coast of the South American mainland, which had not yet been discovered by Europeans. Spain was permitted to claim land to the west of the line, and Portugal could claim land to the east of the line.

Neither nation found this settlement satisfactory. So the next year Spain and Portugal moved the line west to a point about 1,295 miles (2,084 kilometers) west of the Cape Verde Islands, by the Treaty of Tordesillas. This agreement later supported Portugal's claim to territory that is now eastern Brazil. The line was never surveyed, so its exact location was not determined. Scholars think that it lay near the 48° west longitude line.

A continuation of the Line of Demarcation around the globe and into the Eastern Hemisphere gave Portugal the right to claim the Philippine Islands. Spain recog-



WORLD BOOK map

The Line of Demarcation separated the Portuguese and Spanish zones of influence in the Western Hemisphere. The Treaty of Saragossa did the same in the Eastern Hemisphere.

nized this claim in the Treaty of Saragossa in 1529, which set the line 17° east of the Moluccas (Spice Islands). In later treaties with Spain, Portugal gave up its claim to the Philippines and won the rest of Brazil. But Portugal and Spain could not secure all the newly discovered lands, because France, England, and the Netherlands ignored the Line of Demarcation and claimed territory for themselves.

Carla Rahn Phillips and William D. Phillips, Jr.

Linear accelerator. See **Particle accelerator.**

Linear electric motor is a device that generates motion along a straight path. Linear motors operate such devices as moving sidewalks and sliding gates. A linear motor can operate these devices more efficiently than can a motor that generates rotary motion. A rotary motor is less efficient because it requires gears or other devices to convert its rotary motion to linear motion. Another use of linear electric motors is in *maglev* (magnetically levitated) vehicles. A maglev vehicle floats above a track, suspended in midair by magnetic force. In some maglev vehicles, magnets that generate this force are part of the motor.

There are two types of linear electric motors: (1) *induction* and (2) *synchronous*. Both types rely on a basic property of magnets—unlike magnet poles attract each other but like poles repel each other. Both kinds consist of a *stator* (a stationary part such as a track) and a *rotor* (a moving part).

Linear induction motors have a stator made of a strip of a *conductor* (a substance through which electric current flows easily). The rotor contains a row of *electromagnets* (devices that become magnets when current flows through them). When the electromagnets are switched on, current flows in the rotor, establishing a magnetic field in and around the rotor. This field, in turn, generates current in the stator. The stator current then creates a wave of magnetic force in and around the stator. The wave interacts with the rotor field, pulling the vehicle forward.

Linear synchronous motors have a stator made up of overlapping electromagnets. The rotor consists of a row of permanent magnets or electromagnets. When the stator is switched on, current in the wires sets up a wave of magnetic force in and around the stator. The wave interacts with the rotor's magnetic fields, moving the rotor along the stator. Richard J. Gran

See also **Air cushion vehicle; Magnetic levitation train.**

Linear measure. See **Weights and measures** (table: Length and distance).

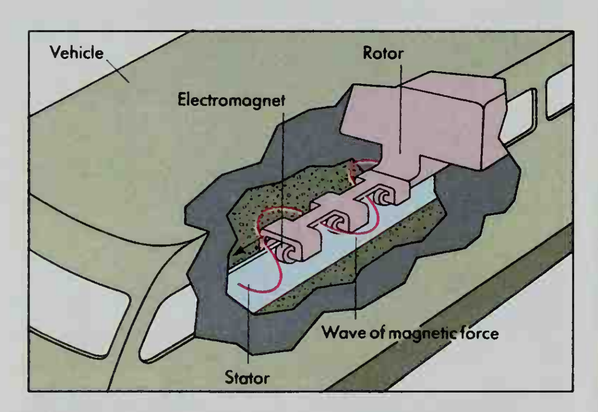
Linen, *LIHN uhn,* is the yarn or cloth made from fibers of the flax plant. The fibers measure from 6 to 40 inches (15 to 100 centimeters) long and are chiefly from the woody part of the plant. The terms *linen* and *flax* are sometimes used interchangeably.

Linen fabrics. Flax ranks among the strongest natural fibers. It is used in a variety of products that require high strength, including sewing thread, fish nets, fire hose, and mattress covers. However, such synthetic fibers as nylon and polyester are even stronger than flax and are used today in many of these products.

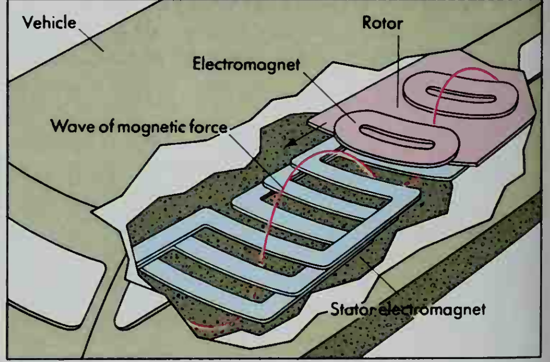
Linen has been a popular fabric for clothing. Linen feels cool because it conducts heat well and carries off the body's heat. Although linen is comfortable, it creases easily. Linen fabric can be treated with a resin to improve its crease resistance, but the fabric becomes less comfortable as a result. Linen fabric is used for tablecloths, napkins, dish towels, and handkerchiefs because it wears well and is highly absorbent.

Preparing the fibers. Flax harvested in late summer produces the finest quality linen. The stalks are pulled, tied into bundles, and dried in the sun. They then pass through a coarse comb that removes the seeds.

Next comes a process called *retting,* which is actually a kind of rotting. In *dew-retting,* the stalks are spread on grass and kept moist for several weeks. The combined action of bacteria and moisture breaks down the tissue surrounding the flax fibers. The fibers can then be separated from the woody bark and straw of the stalk. In *water-retting,* which is more common, the stalks are retted in slow-moving rivers or bogs for one or two weeks. In another method of water-retting, the stems are soaked in large tanks of warm water for four to eight days. Retting with chemicals is quicker than the other methods. But the chemicals used for retting may weaken the flax fibers.



A linear induction motor for a vehicle has a *rotor* (moving part) with electromagnets that create an electric current. This current generates another current in a stationary metal rail called the *stator*. The current in the stator, in turn, generates a wave of magnetic force that propels the vehicle forward.



WORLD BOOK diagrams by Mas Nakagawa

A linear synchronous motor for a vehicle has electromagnets located on its *rotor* (moving part). These electromagnets interact with a wave of magnetic force that is created by electromagnets in the *stator* (stationary path). The magnetic wave moves the rotor along, much as a water wave propels a surfboard.



International Linen Promotion Commission

Linen fabric is both sturdy and beautiful. It is used in making tablecloths, napkins, handkerchiefs, and other items.

After retting, the flax is dried. A machine then breaks the woody bark into small bits and separates out the fibers. Finally, the fiber is combed to produce long fibers called *line* and short, irregular fibers called *tow.* Line is most often woven into high-quality products such as fine tablecloths and very thin fabrics. The yarns spun from tow may be coarse and are generally used in dishtowels and other less expensive items.

History. Flax is one of the oldest fibers in the world. Shreds of cloth made from flax have been found at prehistoric sites in Switzerland. The ancient Egyptians grew flax along the Nile River about 7,000 years ago. They wrapped mummies in linen before placing them in tombs. Egyptian and Israelite priests wore linen cloth at religious ceremonies. Linen is mentioned in the Bible. The ancient Greeks wore linen clothing, and the Romans knew how to make linen paper as well as linen cloth. Linen fabrics were fashionable among the nobility during the Middle Ages.

During the 1600's, skilled Flemish and French workers helped develop linen spinning and weaving in northern Europe. Since that time, linen fabrics from France, Belgium, and Ireland have become internationally famous.

The first American settlers planted flaxseed so that they could make linen. At one time, almost all households in the American Colonies raised flax, spun the yarn, and wove it into linen. However, cotton began to be used in place of linen after the invention of Eli Whitney's cotton gin in 1793. Whitney's gin made cotton yarn cheaper to produce than linen yarn. For that reason, the United States never produced large amounts of fiber flax. Today, fiber flax is not raised commercially in the United States or Canada. Robert A. Barnhardt

See also **Flax**.

Liner. See Ship.

Lingonberry is a small fruit related to the cranberry. It grows wild in northern sections of North America, Europe, and Asia. The lingonberry is known by many other names, including *bog cranberry, cowberry, foxberry, lengon, linberry, lingberry, lingenberry, mountain cranberry, rock cranberry,* and *partridgeberry.*

The fruit of the lingonberry is glossy and bright red. Raw lingonberries taste bitter, so the fruit usually is cooked for use in jellies and sauces. The cooked fruit has a spicy flavor. Lingonberry jellies and sauces are especially popular in eastern Canada and some Scandinavian regions.

Lingonberries grow on low evergreen shrubs. The



WORLD BOOK illustration by Susan Hillier

The lingonberry is related to the cranberry.

plant's leaves are shiny and dark green on top and dark-spotted on the underside. The plant grows best in a cool, mild climate. It is not widely cultivated.

Scientific classification. The lingonberry belongs to the heather family, Ericaceae. Its scientific name is *Vaccinium vitis-idaea.* George W. Eaton

Linguistics is the scientific study of language. Linguists try to answer questions about language, such as how languages change and why words mean what they mean. Linguists study both their own languages and languages they do not speak.

When linguists study a modern language, they analyze the speech of one or more native speakers of that language. They call such a person an *informant.* Many languages have no written form. Therefore, linguists must often use a set of symbols called a *phonetic alphabet* to write down the speech sounds of an informant. Linguists also study dead languages to trace the development of modern ones.

Linguists gather data, form theories and test them, and then establish facts about language. These experts believe they know extremely little about even the most familiar languages. They hope to record and study unfamiliar tongues before such languages become extinct. There are two chief fields of linguistics, *descriptive linguistics* and *comparative and historical linguistics.*

Descriptive linguistics

Descriptive linguistics studies the language of a single place and period. It is sometimes called *synchronic linguistics.* A linguist in this field tries to describe a language as it is acquired by the children of a community and used by the adults there. Such a study focuses on the ability of these people to speak and understand their language. Linguists use the term *linguistic performance* for any utterances people make.

Constructing a grammar. A descriptive linguist records the words and sentences of informants. From this record, the linguist constructs a *grammar,* a description of the ability of people to use their native language. This

ability is called *linguistic competence.* The linguist often relies on the judgment of native speakers for help in constructing a grammar.

All languages have a creative aspect. It consists of the ability of native speakers to produce and understand sentences that they have never encountered before. The number of sentences in a language is infinite, and so no language could be described by listing these sentences. Instead, the linguist devises a grammar that tells, step by step, how to construct any sentence in the language.

The grammar performs its function by telling how to build new sentences out of old ones. For example, the sentence *The astronomer counted the stars* could be substituted for *it* in the sentence *The queen believed it.* This substitution would produce a new sentence, *The queen believed the astronomer counted the stars.*

A grammar may be used *prescriptively* as well as descriptively. Such a grammar attempts to tell people how they should use language. For example, the grammar might suggest using the sentence *I do not have any money* instead of *I do not have no money.* However, the rules of a particular grammar may not reflect the language as it is actually spoken. In addition, people often express their meaning well even if they follow different rules.

The components of a grammar. The grammar of a language has three components: (1) the phonological component, (2) the semantic component, and (3) the syntactic component.

The phonological component consists of rules that tell how to pronounce words and sentences. The *phonology* (sound system) of one language may differ greatly from that of another. For example, Spanish phonology does not distinguish the pronunciation of the two English vowels in the words *sheep* and *ship.* On the other hand, the Thai language distinguishes the sound of the *t*'s in *steam* and *team,* but English does not.

The semantic component tells what sentences mean. It tells whether one sentence means the same thing as another and whether one sentence implies another. For example, *The student managed to pass the test* implies *The student passed the test.* However, the sentence *The student tried to pass the test* does not imply *The student passed the test.*

The syntactic component shows the relationship between the meaning of a sentence and the arrangement of the words in the sentence. It may show that two or more arrangements of words have a single meaning. For example, the two sentences *The waitress gave the sandwich to the tallest girl* and *The waitress gave the tallest girl the sandwich* mean the same thing. Linguists say that such sentences *paraphrase* each other.

The syntactic component may also show that a single arrangement of words has more than one meaning. For example, the sentence *The farmer thought the chicken was too hot to eat* has two possible meanings. Either the farmer thought that his dinner was too warm, or he thought that the chicken refused to eat because of the heat. A sentence that has more than one meaning is *ambiguous.*

Comparative and historical linguistics

Comparative linguistics is the study of language as it varies from place to place, from speaker to speaker, and from one period to another. This field is sometimes called *diachronic linguistics.*

Some comparative linguists attempt to formulate universally valid statements about language structure and language change. This area of study is called *linguistic typology.*

Comparative linguists would like to be able to state how language first developed and to describe the conditions that led to its invention. But written records are relatively recent because human beings have had systems of word writing for only about 5,000 years. People have used spoken languages far longer. As far as linguists can tell, all cultures of today have equally complex languages. For these reasons, almost nothing is known about the origin of language.

Comparative linguists use two chief procedures in their study of language. These procedures are called *internal reconstruction* and *comparative reconstruction.*

Internal reconstruction involves using one stage in the development of a language to explain certain characteristics of an earlier stage. For example, a linguist may notice that the sound of *e* in the words *keep* and *kept* varies with the number of consonants that follow the vowel. The linguist may then hypothesize that the sound of *e* in the two words had been the same in earlier English. The linguist further hypothesizes that a sound change has altered the sound of the vowel in different ways, depending on the number of consonants that follow. Such a change is called a *sound shift.* The same relationship involving the sound of *e* occurs in many other words, including *sleep* and *slept* and *deep* and *depth.*

Comparative reconstruction is a procedure in which a linguist uses several similar languages to reconstruct a hypothetical language, which is called a *protolanguage.* The linguist assumes that the protolanguage was the ancestor of the languages from which it is reconstructed.

A linguist might note that some words that start with a certain letter in various languages start with a different letter in English. For example, the English word *feather* begins with an *f.* The Greek and Latin words for *feather*—*pteron* and *penna*—begin with a *p.* Likewise, the English word *thaw* begins with *th,* and the Greek and Latin versions of the word—*tekein* and *tabes*—begin with *t.* Similarly, the English word *hide* begins with an *h.* The Greek and Latin words for *hide* begin with a *k* or *k*-like sound—*kutos* and *cutis.*

The linguist could hypothesize that Greek and Latin contain the consonants of the protolanguage. As a result, the expert concludes that English underwent a sound shift that systematically replaced some consonants with others. This sound shift characterizes the Germanic languages, which include English, German, and Dutch.

Linguistics and other fields of study

Many linguists study aspects of language that involve other fields. For example, *anthropological linguists* study the influences that language and other elements of culture exert on one another. *Sociolinguists* try to find out how language varies with differences in age, sex, and economic and social status. *Psycholinguists* seek regularities in the ways people acquire and use lan-

guage. They also study diseases and injuries that affect the ability to use language. *Mathematical linguists* are interested in the relation between human languages and the artificial languages used in computer programming. Experts in *applied linguistics* attempt to use linguistic principles to improve the teaching of reading and foreign languages.

History

Comparative and historical research. For hundreds of years, people have been curious about various aspects of language. The comparativists began their studies during the late 1700's. At that time, British politicians and merchants who had lived in India introduced Sanskrit, the ancient language of India, to European scholars. These scholars found grammatical similarities among the Sanskrit, Greek, and Latin languages. They concluded that all three languages, and perhaps others as well, came from a single earlier parent language.

The term *comparative grammar* was first used by the German scholar Friedrich Schlegel in 1808. That concept stimulated modern comparative and historical linguistics. Among the first comparativists was German scholar Jakob Grimm, one of the two brothers known for their collection of fairy tales. Grimm proved that English, German, Dutch, and Scandinavian languages were related to each other and to Sanskrit, Greek, and Latin.

During the 1800's, linguists identified languages that belonged to a family of languages called *Indo-European*—that is, languages located primarily in India and Europe. Linguists compared archaic words of modern languages and analyzed vowel changes and word endings. As a result, they established the origin of words that came from Balto-Slavic, Celtic, Germanic, Greek, Indo-Iranian, and Latin. Today, the Indo-European family has eight branches: Germanic, Romance, Balto-Slavic, Indo-Iranian, Greek, Celtic, Albanian, and Armenian.

During the 1800's, linguists also began a reconstruction of an earlier language known as *Proto-Indo-European* (PIE). No written record of it exists. By 1861, a German linguist named August Schleicher compiled a grammar of PIE. For many years, linguists and anthropologists have searched for the origin of Proto-Indo-European. Since 1945, their research has linked speakers of Proto-Indo-European with a prehistoric culture that developed as early as 5000 B.C. in southeastern Europe, north of the Black Sea. The culture was named *Kurgan,* meaning *barrow,* from the practice of placing mounds of dirt over individual graves.

Structuralism arose in the early 1900's. The structuralists viewed languages as systems composed of patterns of sounds and words. They studied these patterns to learn about the structure of a language. They believed each language has a distinct structure that cannot be compared with that of any other language. A Swiss linguist named Ferdinand de Saussure became the first leader of the structuralists. American structuralists included Leonard Bloomfield and Edward Sapir.

The generative theory of language began during the 1950's with Noam Chomsky, an American linguist. Generative linguists believe that a grammar of a language consists of certain rules for the construction of an infinite number of sentences. Generativists have shown that certain structuralist conceptions of grammar are inadequate for the description of languages.

According to generative linguists, grammatical devices called *grammatical transformations* relate sentences to one another. These transformations are necessary for a complete description of many sentences. This kind of rule had no role in structuralist theory. Beginning in the 1960's, Chomsky's ideas sparked a number of competing theories. There is much disagreement among generative linguists about the basic and universal characteristics of languages. Robert J. Kispert

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Chomsky, Noam
Etymology
Grammar
Grimm
Language
Phonetics
Sapir, Edward
Semantics

Additional resources

Asher, R.E., and Simpson, J. M. Y., eds. *Encyclopedia of Language and Linguistics.* 10 vols. Pergamon, 1994.
Trask, R. L. *A Student's Dictionary of Language and Linguistics.* E. Arnold, 1997.

Liniment, *LIHN uh muhnt,* is a liquid preparation that is used to treat certain aches and pains in the body. It is usually rubbed on the skin to produce reddening and heat. Liniments usually act by causing irritation or stimulation that increases the blood supply to the area. Most liniments are poisonous when swallowed. They should not be used on sores and cuts unless a doctor advises it. Bruce Reider

Link, Edwin Albert (1904-1981), an American inventor and businessman, developed the *mechanical trainer,* a machine that imitates many of the conditions of aircraft flight, yet is permanently attached to the ground. He built his first trainer in 1929, and received his first military order for six units in 1934. During World War II, thousands of Link trainers taught aviators to fly "blind." This ground training saved millions of dollars by reducing the flying time required to train a pilot. Link's company also produced elaborate trainers used by the crews of jet aircraft. He was born on July 26, 1904, at Huntington, Indiana. Roger E. Bilstein

Linnaea. See Twinflower.

Linnaeus, *lih NEE uhs,* **Carolus,** *KAR uh luhs* (1707-1778), a Swedish naturalist and botanist, established the modern scientific method of naming plants and animals. In this system, each living thing has a name with two parts. The first part of the name is for the *genus* (group). The second part is for the *species* (kind). Linnaeus's book *Species Plantarum* (1753) forms the basis for plant classification. The 10th edition of his *Systema Naturae* (1758) covers animal classification. See **Classification, Scientific.**


Ewing Galloway
Carolus Linnaeus

Linnaeus was born May 23, 1707, in Råshult, near Kristianstad, Sweden. His father, the parish curate, wanted him to study for the ministry. But the boy was so interested in plants that friends urged his parents to send him to medical school. While in medi-

cal school, Linnaeus supervised a small botanical garden and began an insect collection. He wrote careful descriptions of all the kinds of plants he knew. These notes formed the basis for his books. He became famous as Carolus Linnaeus because he wrote his books in Latin.

With $50 given him by the Royal Society of Science, he spent five months in 1732 collecting plants in Lapland. During this trip, he walked nearly 1,000 miles (1,600 kilometers). Linnaeus then went to the Netherlands, where he received his medical degree. When he returned to Stockholm to practice medicine, the Swedish government gave him a position. Linnaeus became a professor of botany at Uppsala University in 1742. In 1758, he was granted Swedish nobility and changed his name to Carl von Linné. Carolyn Merchant

Linnet, *LIHN iht,* is a small bird in the finch family. Linnets live in Europe, northern Africa, and western Asia. They are light tan and brown with darker patches on the back and shoulders. In spring and summer, the crown and breast of male linnets turn crimson. Like other finches, linnets have a sturdy bill that is well adapted to holding and cracking the seeds they eat.



Dennis Green, Bruce Coleman Ltd.

A male linnet feeds its hungry young.

These birds inhabit thickets, shrubs, and the edges of forests during the spring and summer, when they nest. They flock together in open country during the fall and winter. Some linnets migrate to warmer regions for the winter. Others stay in the same area all year.

Linnets build cuplike nests of stalks and grasses. They line the nests with feathers or fur. A nest usually is placed low in a shrub or tree growing in the open. Female linnets lay from 4 to 6 spotted, pale-bluish eggs. In North America, the distantly related house finch is sometimes called a linnet. David M. Niles

Scientific classification. The linnet belongs to the subfamily Carduelinae of the finch family, Fringillidae. It is *Carduelis cannabina.*

Linoleum, *luh NOH lee uhm,* is a smooth-surfaced floor covering made from linseed oil. It was the first smooth floor covering to be manufactured on a large scale. Linoleum blocks are often used for block printing (see **Block printing**).

To make linoleum, a manufacturer first mixes purified linseed oil and oxygen in a tank, creating a rubbery substance. Heat and certain gums are added to strengthen the mixture. The resulting *linoleum cement* is then stored for several days to give it even greater toughness. The manufacturer then mixes the cement with pigments and such filler materials as ground cork and wood flour. A machine *calenders* (presses) the substance until it is glossy and applies it to a backing sheet of burlap or felt. In a process called *stoving,* the backed linoleum is dried and hardened in an oven. The product is then coated with lacquer or wax.

Manufacturers produce linoleum in solid colors and in a variety of designs. They cut designs from two or more sheets of different solid colors and put the pieces together on a backing sheet to create inlaid patterns. In another method for producing patterns, manufacturers grind sheets of various colors and then put the resulting granules through a series of stencils onto the backing sheet. Manufacturers can also mix granules of two or more colors loosely on a backing to produce a pattern similar in appearance to marble or granite.

Linoleum was invented about 1860 by Frederick Walton of England. He found that linseed oil, when exposed to air, became a rubberlike material. The oil comes from the flax plant, and so he called the product linoleum, from the Latin words *linum* (flax) and *oleum* (oil). In the early 1900's, Walton invented a *straight-line inlay machine,* which produced linoleum in various patterns. Manufacturers still make linoleum by Walton's basic method, but the modern process is much faster. The use of linoleum started to decline during the 1950's as floor coverings made of plastics replaced it in many homes and offices. In the late 1900's and early 2000's, linoleum gained in popularity again. People concerned about the environment have helped promote the product because it is made entirely of natural materials.

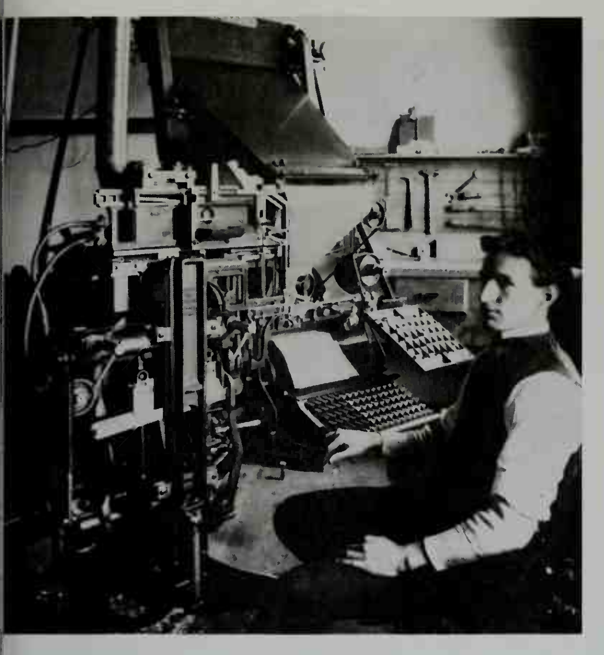
Critically reviewed by the World Floor Covering Association

Linoleum-block printing. See Block printing.

Linotype, *LY nuh typ,* is the brand name of a machine used to produce metal type for printing. It is the best-known brand of *linecaster,* a machine that forms a complete line of type at one time. Linotype typesetters were once used in the publication of nearly all newspapers and other printed material. However, *photocomposition* has almost entirely replaced the Linotype. Photocomposition is any of several methods of assembling images on photosensitive film or paper, or directly on a printing plate (see **Printing** [Typesetting]).

How the Linotype works. The Linotype is operated by one person seated at a keyboard. Above the keyboard is a slotted metal tray called a *magazine.* The magazine holds hundreds of tiny brass molds that are in the shape of letters. These molds, which are called *mats* or *matrices,* fit into the slots of the magazine that correspond to keys on the keyboard. When the operator presses a letter key, the magazine releases the corresponding matrix, which drops into place in a line. At the end of each word, the operator presses another key to insert a *space band,* an expandable metal wedge. After reaching the end of the line, the operator *justifies* the line. Justification involves extending the line to fill its intended length and driving the space bands between the words to create equal amounts of space between them.

When the line is completed, the operator presses a key to send the line to be cast. Molten metal, usually





Lori Meek Family Collection; © David R. Frazier

A Linotype, *shown in black and white,* is a machine that produces metal type for printing. It casts the type in one-line units called *slugs, shown in color.* The Linotype has been gradually replaced by photographic typesetting.

lead, is forced into the matrices. As the metal cools, it hardens into a line of type with raised letters. This *slug* then drops into a tray called a *galley,* while the empty matrices are carried back up to the magazine by a mechanical arm. The matrices are automatically sorted and returned to their slots to be used again. After printing, the slugs are melted down and the metal reused.

History. Ottmar Mergenthaler, a German-born inventor, demonstrated and patented the Linotype in 1884. The *New York Tribune* gave the Linotype its first major commercial use in 1886. In 1890, Mergenthaler introduced an improved machine, called the Simplex Linotype, which became a worldwide success. Before Mergenthaler's invention, galleys were assembled and taken apart by hand, one letter at a time. The Linotype improved typesetting speed and reduced its cost.

Linotype typesetters were used in nearly all typesetting work until the 1960's, when photocomposition began to replace metal composition. Today, most type produced in the United States is set by photocomposition. However, in many parts of Africa, Asia, and South America, Linotype typesetters still are commonly used.

J. C. McCracken

See also **Mergenthaler, Ottmar; Monotype; Printing.**

Linseed oil is an oil derived from the seeds of the flax plant. It is a type of *drying oil*—that is, it takes in oxygen from the air to form a tough film that resists breaking, chipping, and changes in the weather. Linseed oil is used primarily in printing inks, paints, varnishes, linoleum, and other industrial products. In addition, it is sometimes used as a protective treatment for concrete.

Flaxseeds are made up of about 40 percent oil and 60 percent water and solid material. To obtain linseed oil, workers grind the flaxseeds into a meal and heat it. This meal is then either crushed by a hydraulic press or treated with chemicals called *solvents* to extract the oil. The oil is refined to remove impurities. Freshly extracted linseed oil is dark brown, but the refined product is light yellow. The remaining meal, which is high in protein, is used as feed for livestock.

Today, synthetic chemicals have replaced many of the uses of seed oil. As a result, world production of the oil is declining. Daniel R. Sullivan

See also **Flax; Linoleum; Paint.**

Linsey-woolsey is a rough cloth made of linen and wool. It is hand-woven and hand-spun with the linen threads running lengthwise, and the wool running crosswise.

Linsey-woolsey was made by early American colonists and by pioneers of the American West until after the American Civil War (1861-1865). They used linen threads because they did not have enough wool. Today, few people make linsey-woolsey. O. Frank Hunter

Lintel. See **Architecture** (table: Architectural terms [Post and lintel]).

Linton, Ralph (1893-1953), was an American anthropologist. He developed the concepts of *status* and *role,* which are used by many social scientists.

According to Linton, a person's status consists of a "collection of rights and duties." Such status is either achieved by a person's own efforts, or given by society to an individual based on such traits as age, parentage, and sex. Linton believed a person's status shapes his or her role—that is, the way the person functions in society. Linton also showed how a person's role affects his or her personality. He helped develop the view that each culture produces a particular basic personality type.

Linton was born in Philadelphia. While earning a Ph.D. degree at Harvard University, he researched the archaeology of Polynesia. From 1925 to 1927, he lived in Madagascar and studied the culture there. He later taught at the University of Wisconsin and at Columbia and Yale universities. Linton's books include *The Study of Man* (1936) and *The Cultural Background of Personality* (1945).

Igor Kopytoff

Lion, in astrology. See **Leo.**



Norman Myers

A pride of lions moves across an open, grassy plain in Africa.

Lion is a big, powerful cat. It is probably the most famous member of the cat family. People are frightened by the lion's thundering roar and impressed by its strength and royal appearance. The lion is called the "king of beasts," and is a well-known symbol of both beauty and power.

Lions can live in cool climates and in the intense heat of semidesert areas. They do not like to live in thick forests. Most of them live in woodlands, grassy plains, and areas with thorny scrub trees. Lions live where they find a supply of food—deer, antelope, zebra, and other hoofed animals—and where they have a place to drink.

In ancient times, lions lived in Europe, the Middle East, India, and much of Africa. But human beings have killed thousands of lions as people settled in new areas. As a result, there are no more lions left in the Middle East and northern Africa. Only about 200 lions still live in Asia—all in the Gir Forest in India. Lions still live in the eastern part of central Africa and in southern Africa. But most of these lions live in national parks and areas called *reserves,* where the animals are protected from hunters.

Hundreds of lions also live in captivity in zoos throughout the world. And trained lions are popular performers in circuses.

George B. Schaller, the contributor of this article, is Director for Science Wildlife Conservation Society, New York, and has studied lions in Tanzania, East Africa. He has written articles on lions and their behavior, and is author of The Deer and the Tiger.

The body of a lion

The lion is the second largest member of the cat family. Only the tiger is larger. Lions are built for strength, not speed. A male lion usually weighs from 350 to 400 pounds (159 to 180 kilograms), but some weigh up to 560 pounds (254 kilograms). Most males are about 9 feet (3 meters) long from the nose to the end of the tail. They average about 4 feet (120 centimeters) tall at the shoulder. *Lionesses* (females) are smaller than males. They weigh only 250 to 300 pounds (113 to 140 kilograms) and are about 1 foot (30 centimeters) shorter.

Male lions are the only cats with *manes.* This collar of long, thick hair covers the head, except the face, and the neck down to the shoulders and chest. The mane makes

Facts in brief

Names: *Male,* lion; *female,* lioness; *young,* cub; *group,* pride.
Gestation period: About 3 ½ months.
Number in litter: 1 to 6, usually 2 or 3.
Length of life: 20 to 25 years, in captivity; in the wild, 15 to 20 years.
Where found: Africa south of the Sahara; the Gir Forest of India.
Scientific classification: Lions belong to the class Mammalia, and the order Carnivora. They are in the cat family, Felidae. Their scientific name is *Panthera leo.*

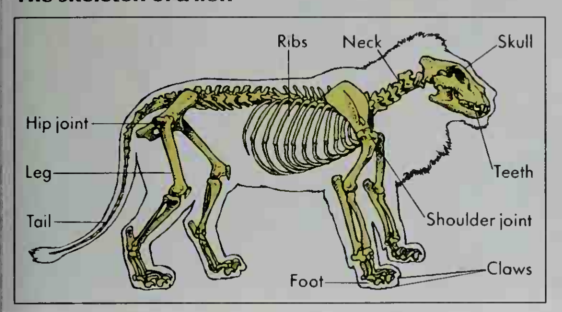
the male look even bigger and stronger than he is. It also protects him during fights. The long, thick hair softens the blows of his foes. Young males have a little hair around their heads when they are about a year old. The mane is not fully grown until the animal is about 5 years old. Manes may be blond, brown, or black. Most are a mixture of these colors. They darken as the lion grows.

The lion's coat is ideal for hiding. It is a brownish yellow, the same color as dead grass. Only the back of the ears and the tuft of hair at the end of the tail are black. *Cubs* (young lions) have spots on their coats.

The shoulders and forelegs of the lion are tremendously muscular. They give the lion the strength to clutch its prey and pull it to the ground. Each big, heavy paw is armed with curved claws that hook and hold the prey. When not in use, each claw withdraws into a sheath in the paw so the claws stay sharp.

The lion has 30 teeth. The four large *canine* (pointed) teeth are used to hold the prey, kill it, and to tear the meat. Four cheek teeth called the *carnassial* teeth are for cutting through tough skin and the *tendons* that join muscles to bone. There are no teeth suitable for chewing. The lion swallows food in chunks.

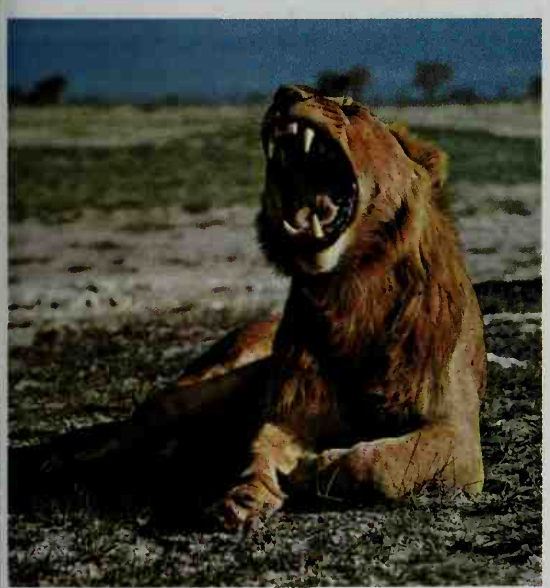
The skeleton of a lion



Lion tracks



WORLD BOOK illustration by John D. Dawson



Norman Myers, Photo Researchers

A lion's long, sharp teeth and huge paws are fearsome weapons. The lion can disable or kill some prey with one swipe, then use its pointed teeth to tear the prey apart.

The life of a lion

The lion is the most companionable of all cats. A *pride* (group) may include from 10 to 20 lions, or as many as 40. Each pride has from one to seven adult males, several lionesses, and cubs. The members of the pride may not always be together. Some of the lions may hunt in one place, a few in another. But when they are reunited, they greet each other by rubbing cheeks.

Life within the pride is peaceful. Lions usually spend about 20 hours a day sleeping or resting. Cubs chase each other and wrestle. A lioness sometimes twitches her tail while one of her cubs tries to catch the tuft of hair at the end of the tail. Hungry cubs nurse on any lioness that has milk, not just their own mothers.

Lions usually walk about 5 miles (8 kilometers) in a day. If they have had a big meal, they may rest for 24 hours. But if they are hungry, they may travel as far as 15 miles (24 kilometers) in search of food.

Habits. Each pride stays in a specific *territory* (area). The territory has food and water for the lions. Where prey is plentiful, the territory may cover about 15 square miles (39 square kilometers). Where prey is scarce, it may be 100 square miles (260 square kilometers).

Lions do not allow strange animals to hunt in their territory. They warn intruders to stay away by roaring or by squirting a mixture of scent and urine on bushes. The strangers then know that the territory is occupied. If they ignore the warnings, they may be killed.

Pride members stay together like a family for years, but changes occur from time to time. All male cubs are chased from the territory by their fathers when they are between 2 and 3 years old. These young males then wander until they are fully grown. Then they may challenge some pride males. If they win, they can take over the territory and the lionesses it contains. Lions in captivity die of old age at about 20 to 25 years.

Cubs. A lioness becomes an adult and mates with the pride males when she is from 3 to 4 years old. About 3 $\frac{1}{2}$ months later, her cubs are born in a thicket. The cubs are blind and helpless at birth, and weigh about 3 pounds (1.4 kilograms) each. Lions do not have permanent dens. From time to time, the mother moves her cubs from one hiding place to another. She carries them in her mouth, one at a time. Hyenas, leopards, and even other lions may kill cubs while the mother is away hunting. Lions also have mated with tigers in captivity. Their offspring may be called a *tiglon,* a *tigon,* or a *liger.*

At first, the cubs live on milk. When they are about 1 $\frac{1}{2}$ months old, the mother leads them to an animal she has killed for their first meal of meat. The lioness usually does not have another litter until her cubs are 20 to 30 months old, old enough to hunt for themselves. Occa-





Marc & Evelyne Bernheim, Rapho Guillumette

Lions like to rest in a cool, shady spot. The lionesses shown here care for their cubs. Many male lions like to stretch out in the branches of a tree for a quiet nap. Females do most of the hunting. Males keep the pride's territory safe from intruders.

sionally, a mother abandons her cubs. When food is scarce, the mother eats and lets the cubs starve. About half the cubs survive.

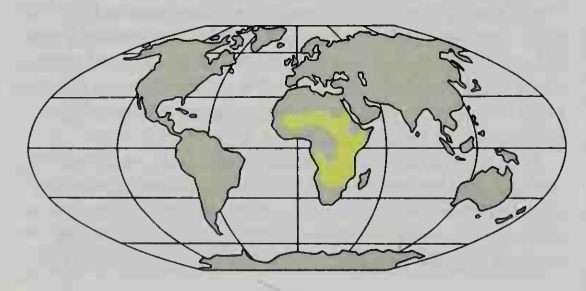
How a lion hunts

Lions have to kill to live. They prefer large prey— zebra, various kinds of antelope, buffalo, and warthog. But they will also eat fish, turtles, guinea fowl—anything they can catch. They eat animals that have died from disease, and even take prey from cheetahs or hyenas.

The lion lives a life of feast or famine. It may not be able to catch an animal for perhaps a week. But it usually catches something to eat every three or four days. Then the lion stuffs itself. A male lion can eat 75 pounds (34 kilograms) of meat in one meal. After killing an animal, the lion often drags it to a shady spot. One lion can drag a 600-pound (270-kilogram) zebra, something that six people would find difficult to do. All members of the pride eat together, with much growling and snarling as each animal tries to get the "lion's share" of the meat.

Where lions live

The yellow areas in the map show the parts of the world in which lions are found. Most lions live in the African plains.

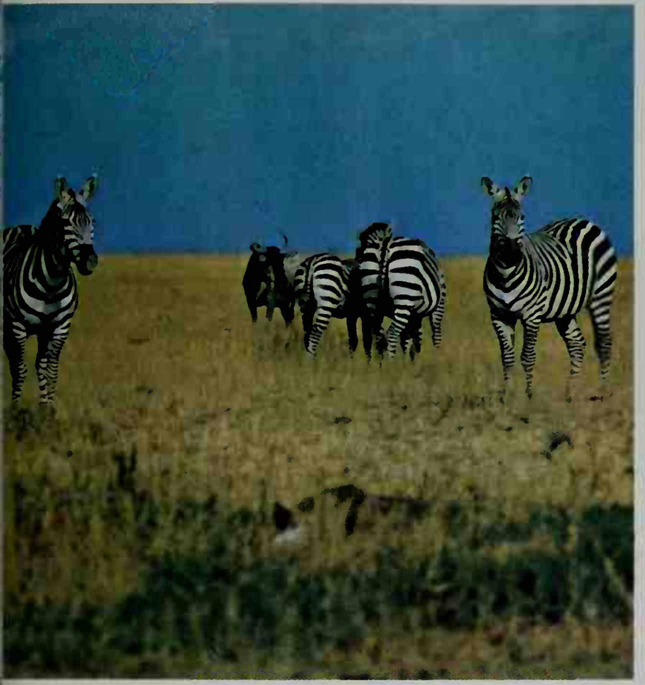


Catching a large animal is not easy for the lion. Most of its prey can run faster than the lion, which has a top speed of about 35 miles (56 kilometers) per hour. A lion normally must surprise its victims by stalking. After locating the prey, the lion moves slowly towards it, its body close to the ground. When it is about 50 feet (15 meters) away, it rushes forward, grabs the rump, side, or head of the animal, and pulls it to the ground. Then it usually seizes the prey's throat in its mouth and strangles it.

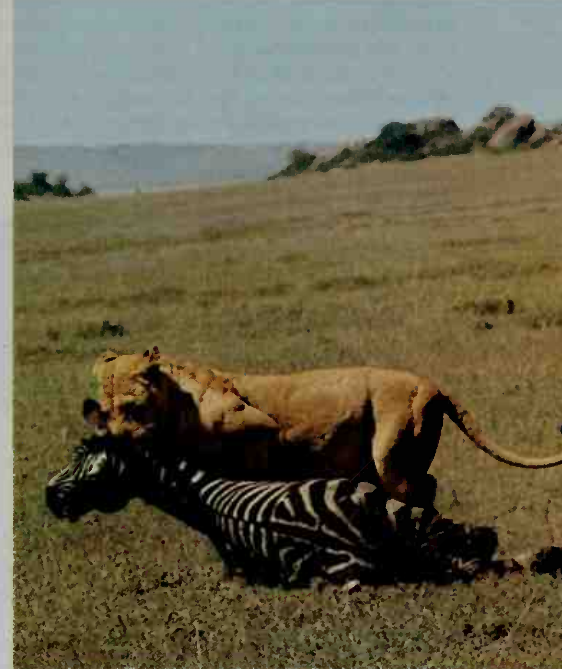
Lions often hunt at night because they can surprise their prey more easily in the dark. Nature has equipped the lion well for this task. Its gold-colored eyes can see in the dark, and the lion has excellent senses of hearing and smell. Sometimes several lions hunt together. While several hide, others circle the prey and chase it toward the waiting lions that are crouched in the high grass. The male lions in the pride ordinarily let the lionesses do the hunting. But they kill for themselves when they find prey. Cubs learn to hunt by watching the adults.

Lions and people

Hunting lions. Whenever lions and people come into contact, the lion always loses. People have killed the li-



Norman Myers



Richard Dranitzke, Photo Researchers

A lioness stalks her prey. Partially hidden in tall grass, *center foreground,* she creeps close to a herd of zebras. Then she suddenly leaps out, pulls her prey to the ground, and kills it. After making the kill, she drags the dead zebra to cover, where the whole pride will feast on it.

ons in most of Asia and much of Africa. Lions kill cows, goats, and other livestock for food. And on rare occasions they kill people. So people killed lions to protect themselves and their property.

For hundreds of years people have also hunted lions as a way of showing courage. In about 1375 B.C., the Egyptian *pharaoh* (ruler) Amenhotep III hunted lions with bow and arrow from a chariot. He killed 102 in this manner. During the Seventh Crusade, Saint Louis and his followers chased lions on horseback and shot them with crossbows. Warriors of the Maasai tribe in East Africa used to hunt lions on foot.

The Asiatic lion is an endangered species. The only Asiatic lions that remain in their natural habitat live in India's Gir Forest sanctuary. But the people who live there have destroyed much of the lions' habitat by cutting down trees for fuel and timber. Deer and other natural prey are scarce in many areas, and so the lions have killed domestic animals, such as cattle, for food. This has made the lions unpopular with farmers in the area.

African lions have a much better chance for survival. Africa has many reserves where lions may not be shot. Hunters are still allowed to kill lions in certain areas, but they must have a special license. Most people would rather photograph lions than shoot them now.

The lion tries to avoid contacts with people. It rarely attacks people unless it is tormented or injured. For example, a person can be within 40 feet (12 meters) of lions in the Gir Forest without danger. People there seldom harm the lions. But when provoked, and particularly when wounded, the lion is a terrible foe.

Training lions. Lions have been kept in captivity for centuries. Pharaoh Ramses II took a tame lion into battle as a mascot. The Roman Elagabalus rode in a chariot that was pulled by lions.

Trained lions have always been a favorite attraction in circuses and *menageries* (collections of wild animals). Lions can be trained to do tricks. The fact that lions look ferocious makes them spectacular show animals.

Training usually begins when a lion is about 2 years old. As long as the trainer is not careless, does not treat the lion cruelly, and remembers it is never completely tame, the trainer is safe. But lions always are liable to attack, and have mauled and even killed trainers.

In the past, lions were frequently caught in the wild and taken to zoos and circuses. They were trapped in nets or in pits dug in the ground. Sometimes cubs were taken from their mothers. Now, enough lions are born in captivity to fill zoo and circus needs. Some lionesses in zoos have as many as three litters in one year.

Lion cubs can be tamed easily. While they are small, they make delightful pets. Once they grow up, they are so big, strong, and potentially dangerous that they cannot be kept in the home. George B. Schaller

See also **Animal** (Animals of the grasslands [picture]).

Additional resources

Bertram, Brian. *Lions.* Voyageur Pr., 1998.
Darling, Kathy. *Lions.* Carolrhoda, 2000. Younger readers.
Joubert, Dereck and Beverly. *Hunting with the Moon: The Lions of Savuti.* National Geographic Soc., 1997.

Lions Clubs International, also called the International Association of Lions Clubs, ranks as the world's largest service club organization. It has more than 44,000 clubs and approximately $1\frac{1}{2}$ million club members in about 165 countries and territories. Lions Clubs are associations of business and professional men and women who seek to recognize and meet the needs of their communities.

Club activities include sight conservation and work for the blind; drug awareness; diabetes education and research; hearing conservation and work for the deaf; citizenship, educational, health, and social services; and work for international cooperation and understanding, including international youth camp and youth exchange programs. Some Lions Clubs sponsor Leo Clubs for young adults. The Lions Clubs International Foundation raises funds to aid disaster victims and provides vocational training for disabled people and the poor.



Lions Clubs emblem

The association was founded in Chicago in 1917. It publishes *The Lion Magazine* in English and 18 other languages. The organization holds an international convention each year. It has headquarters in Oak Brook, Illinois. Critically reviewed by the Lions Clubs International

Lip. See Mouth.

Lip reading is the technique by which one person understands the speech of another without hearing any sounds. A person does this by watching another person's mouth to see the shape it makes as each word is pronounced. Lip reading, also called *speechreading,* is used by people who are deaf or hard-of-hearing.

Lip reading was used in the 1500's by the earliest teachers of the deaf. In 1778, Samuel Heinicke helped establish lip reading as a part of the German system of teaching the deaf. In 1843, the American educator Horace Mann observed methods of lip reading used in Germany. Mann urged that these techniques be adopted in the United States to provide a means of understanding the spoken word for the country's deaf and hard-of-hearing people. Mann's proposals led to the establishment of the first lip-reading school in the United States in 1867. Today, many schools for the deaf emphasize lip reading. Some audiologists, deaf educators, and speech-language pathologists offer lip-reading instruction, as do many public school systems.

It is not easy to become a skilled lip reader. Most speech sounds are formed by moving the tongue to make contact with the soft palate, teeth, or lips. These movements may not be visible to the eye. Lip reading can only be a supplementary strategy to other methods of teaching speech and language, either through auditory approaches or combined with some form of sign language. One such method, called *cued speech,* uses hand signals along with lip movements to represent speech sounds. Russell L. Malone

Lipase. See Enzyme (picture: Enzymes); Stomach (The stomach's work).


Bronze sculpture (1938); Hirshhorn Museum & Sculpture Garden, Smithsonian Institution, gift of Joseph H. Hirshhorn, 1966/Joseph Martin (SCALA/Art Resource)

Lipchitz's *Rape of Europa II* illustrates the sculptor's powerful and dramatic treatment of mythological subjects.

Lipchitz, *LIHP shihts,* **Jacques,** *zhahk* (1891-1973), was a sculptor whose work represents many of the major movements in modern sculpture. He studied sculpture in Paris, and his early work shows the influence of the French sculptor Auguste Rodin. Lipchitz met Pablo Picasso and, beginning in 1913, his sculpture reflects the style of Cubism, with its overlapping, interacting planes. His forms gradually became more flexible, and he began creating what he called *transparent sculpture.* This style emphasized form distorted by movement and external and internal forces that seem to be pulling in opposite directions. By the 1930's, Lipchitz had abandoned Cubism. He turned to Expressionism and Surrealism, with its emphasis on the subconscious. More violent, sometimes mythological themes replaced the Cubist symbols in his work.

Lipchitz was born on Aug. 22, 1891, in what is now Lithuania. He studied and worked in Paris from 1909 to 1941, then moved to the United States to escape the Nazis. He became a U.S. citizen in 1957. He died on May 26, 1973. George Gurney

See also Sculpture (Modern international sculpture).

Lipid, *LIHP ihd* or *LY pihd,* is one of a large group of oily or fatty substances essential for good health. Lipids, carbohydrates, and proteins are the classes of compounds in all living things. Animal fats and plant oils are lipids. So are sex hormones and vitamins A, D, E, and K. Egg yolks, liver, and embryos of grains are rich in lipids.

Importance of lipids. Lipids are vital to animals and plants in many ways. They are a concentrated source of food energy and yield about twice as many calories as an equal weight of protein or carbohydrate. Many kinds of organisms store food in lipid form. For example, the seeds of many plants contain lipids as food reserves for their embryos. The bone marrow, tissues beneath the skin and in the intestines, and tissue surrounding body organs in animals consist mostly of stored lipids.

Certain lipids form an essential part of the membranes that enclose and protect every living cell. Similar membranes surround all bodies within the cell, so that each cell body can do its job without unwanted interference from other cell bodies. Lipids repel water, but they are valuable *solvents* (dissolving substances) for vitamins A, D, E, and K, which do not dissolve in water.

Kinds of lipids. Lipids are classified as *simple lipids* or *complex lipids,* according to their structure.

Simple lipids contain only carbon, hydrogen, and oxygen. They consist of an alcohol in combination with certain organic acids containing a variable number of carbon atoms. A molecule of *triglyceride* (fat), the most common type of simple lipid, contains one molecule of an alcohol called *glycerol* and three molecules of *fatty acid* (a kind of organic acid). Fats include butter, lard (pig fat), tallow (beef or mutton fat), blubber (whale fat), castor oil, coconut oil, and olive oil. Waxes, another common group of simple lipids, contain an alcohol molecule that is larger than the glycerol molecule. For more details, see **Fat; Oil** (Fixed oils); **Vegetable oil; Wax.**

Complex lipids have a more complicated structure than simple lipids. Complex lipids include *phospholipids* (lipids that contain phosphorus), *steroids* (lipids made up of four rings of carbon atoms joined together), and other compounds such as *glycolipids* (lipids with one or more sugar molecules), *fat-soluble vitamins* (vitamins A, D, E, and K), and *terpenes* (yellow pigments like carotene).

Phospholipids are found in all bacteria, and in the cells of all plants and animals. Phospholipids are most plentiful in sperm, eggs, embryos, and brain cells. A molecule of phospholipid contains a molecule of glycerol, a phosphate ion, and two molecules of fatty acid. Most phospholipids also have a nitrogen compound. Some contain *inositol,* a substance found in vitamin B complex.

Steroids make up an important part of living things. Many animal hormones, including the sex hormones and those produced by the *cortex* (outer part) of the adrenal glands, are steroids. Cholesterol, a substance found in the membranes of animal cells, is a steroid. Yeasts and other fungi and the seeds of higher plants also contain steroids. Quinton R. Rogers

Lipizzan. See **Horse** (Saddle horses).

Lipmann, Fritz Albert (1899-1986), a German-born American biochemist, won a share of the 1953 Nobel Prize in physiology or medicine. Lipmann won for discovering coenzyme A while a researcher at Massachusetts General Hospital in Boston in 1945 and identifying it as a substance that helps the body produce energy from food. Previously, he had shown that a chemical compound called *adenosine triphosphate* (ATP) is the major form of chemical energy in the cell. He was born on June 12, 1899, in Königsberg, Germany (now Kaliningrad, Russia), and died on July 24, 1986, in Poughkeepsie, New York. Frederick B. Rudolph

Lippershey, Hans. See **Telescope.**

Lippi, *LIHP ee,* **Filippino,** *FIHL uh PEE noh* (1457?-1504), was an important painter of the Italian Renaissance. His father and first teacher, Filippo Lippi, also was a noted painter. However, Filippino learned much of his style from Italian artist Sandro Botticelli.

Lippi was born in Prato. He achieved early success in Florence that brought him a number of major commissions. In 1488, Lippi went to Rome, where he decorated a chapel with scenes from the life of Saint Thomas Aquinas. In Rome, he developed an interest in Roman art that was reflected in his late works.

Lippi returned to Florence by 1493 and from 1500 to 1502 painted his most important late works, scenes from the lives of Saint Philip and Saint John. These paintings feature complex compositions, restless figures, and exaggerated and unusual lighting and backgrounds. Lippi's work influenced a group of Italian painters of the 1500's known as *mannerists.* Vernon Hyde Minor

Lippi, *LIHP ee,* **Filippo,** *fih LIHP oh* (1406?-1469), was a leading painter of the Italian Renaissance. He painted religious subjects on altarpieces and in *frescoes* (paintings on damp plaster) in various towns in Italy. His earlier works show the influence of the Renaissance painters Masaccio and Fra Angelico in their rich colors, deep shadows, and three-dimensional figures. His later paintings are brighter and more decorative and place greater emphasis on line. His most ambitious and best-known works are a series of frescoes (1452-1464) in the Cathedral of Prato that depict scenes from the lives of Saint Stephen and Saint John the Baptist.



Tempera and gold painting on wood (mid-1400's); Metropolitan Museum of Art, the Jules Bache Collection, 1949

***The Madonna and Child* by Fra Filippo Lippi** has a warm human quality for which the great Italian painter was famous. Lippi's son, Filippino, was also a celebrated artist.

Lippi was born in Florence. He became a monk and is sometimes called Fra (Brother) Filippo Lippi. Lippi eloped with a nun in 1456. In about 1457, they had a son, Filippino, who also became a noted Renaissance painter. The couple were later released from their religious vows and married. Vernon Hyde Minor

Lippmann, Walter (1889-1974), was an American journalist who won worldwide fame as a political writer and philosopher. He became known for his clear, thoughtful writing.

In his writings, Lippmann expressed the view that civi-

lized society could exist only if people govern their conduct by reason instead of impulse. He urged politicians to base their decisions on statesmanship rather than politics. Lippmann's opinions influenced political leaders throughout the world. Several United States presidents asked him for advice on various issues.

From 1931 to 1967, Lippmann wrote a column called "Today and Tomorrow" for the *New York Herald Tribune.* It eventually was printed in more than 200 newspapers. Lippmann won the 1962 Pulitzer Prize for international reporting and a special Pulitzer citation in 1958 for his commentary on national and international affairs.

Lippmann began his career in 1911 with *Everybody's Magazine.* In 1914, he helped found the *New Republic* magazine. Lippmann joined the staff of the *New York World* in 1921. He served as editor of the *World* from 1929 until the paper ceased publication in 1931.

Lippmann was born on Sept. 23, 1889, in New York City. He graduated from Harvard University in 1910. After the United States entered World War I in 1917, he served in various government positions for about two years. He helped President Woodrow Wilson prepare the Fourteen Points that Wilson hoped would form the basis of a peace settlement (see **Fourteen Points**).

Lippmann wrote over 20 books. Lippmann's books include *A Preface to Politics* (1913), *Public Opinion* (1922), and *The Public Philosophy* (1955). Robert K. Stewart

Lippold, Richard (1915-), is an American sculptor. He creates complicated airy suspensions that seem to capture space and rays of light in thin gold wires that are sometimes enameled. An example of his delicate abstract and geometric work is *Variation Number 7: Full Moon.* Lippold was born on May 3, 1915, in Milwaukee. He studied industrial design at the University of Chicago and the Art Institute of Chicago. Lippold created many sculptures for public buildings, including Avery Fisher Hall in Lincoln Center in New York City. George Gurney

Lipton, Sir Thomas Johnstone (1850-1931), a British tea merchant, became famous as a yachtsman. From 1899 to 1930, he made five attempts to win the America's Cup, the highest award of international yachting. Lipton never won the cup, but his sportsmanship in defeat endeared him to Americans.

Lipton began his career as a laborer and grocer's assistant in the United States from 1865 to 1869. On his twenty-first birthday, he opened in Glasgow, Scotland, the first of a chain of food stores, and in 1890 he entered the tea business. His successful advertising methods made his products widely known.

Lipton was born on May 10, 1850, in Glasgow. He left his fortune to that city for hospitals. William R. Childs

Liqueur. See **Alcoholic beverage** (Liqueurs).

Liquid is one of the three basic states in which matter exists. The other two states are gaseous and solid. A liquid is similar to a gas because its molecules are not fixed to each other in any particular way. Liquids and gases are both called *fluids* because they can flow to fit the shape of any container in which they are put. A liquid is unlike a gas and similar to a solid because it has a definite volume, and its molecules are only slightly compressible. A liquid always seeks its own level. If a liquid is put in a container with several arms, it will rise to the same level in all the arms.

A thin layer on the surface of a liquid has a tension caused by molecular action, and acts like a skin. This is called *surface tension.* Due to surface tension, a greased needle will rest on the surface of water without sinking.

The molecules of a liquid often have a greater attraction for other substances than they have for each other. For this reason, they will rise in narrow tubes above their own level. This action is called *capillarity.* Plants draw water by capillary action.

If liquids are heated beyond a certain point, they *vaporize* (change into gas). Water changes into steam when it boils. If liquids are cooled below a certain point, they change into solids. Water freezes into ice. Different liquids have different freezing and boiling points. Substances that are normally gases can be cooled and compressed into a liquid state. Some normally solid substances can be heated until they turn into liquids. For more information, see the articles on **Gas**, **Solid**, and **Water**. Richard A. Martin

Related articles in *World Book* include:

Boiling point	Freezing point	Molecule	Surface tension
Capillarity	Hydraulics	Osmosis	Vapor
Density	Liquid air	Siphon	Viscosity
Diffusion	Matter	Solution	
Distillation	Melting point	Superfluid	

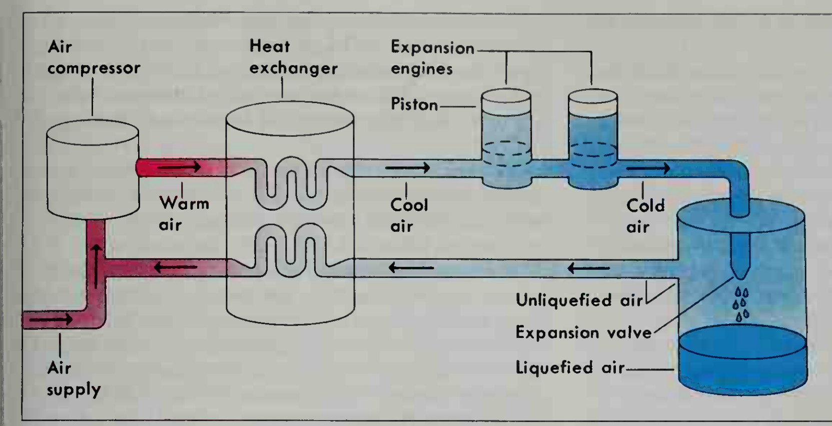
Liquid air is a product made by greatly reducing the temperature of air until it turns into a fluid. Air becomes liquid at about -190 °C. The liquid is bluish and looks like water. Liquid air, like the air we breathe, consists of about 78 percent nitrogen, 21 percent oxygen, and 1 percent argon.

Scientists use liquid air in *cryogenics,* the study of temperatures -100 °C and lower (see **Cryogenics**). Liquid air is considered a *cryogenic fluid* because of its extremely low temperature. It is a primary source of liquid forms of nitrogen and oxygen. Scientists use liquid nitrogen in biology, chemistry, and physics research. It is also used in refrigerating and processing food. Liquid oxygen is used in compact, high-energy fuels for rocket engines that power spacecraft. It is also used to make explosives for blasting.

Properties. Liquid air affects different substances in various ways. Liquid mercury becomes as hard as steel when liquid air is poured over it. A tennis ball dipped in liquid air will shatter when bounced. A lead bell, which normally makes a dull sound, will temporarily produce a clear tone when it has been exposed to liquid air.

Scientists use liquid air to study the effects of extremely low temperatures on the strength of certain substances. Such materials as iron and plastics temporarily become brittle after being dipped into liquid air. However, copper and brass become tougher upon immersion in the fluid. Exposure to liquid air also makes metals better conductors of electricity and increases the strength of certain types of magnets.

Scientists measure the temperature of liquid air with special thermometers because mercury and alcohol thermometers cannot be used. Mercury and alcohol freeze at temperatures much higher than that of liquid air. The most accurate and widely used thermometer that measures the temperature of liquid air is the *platinum resistance thermometer.* It measures temperature by determining its effect on the electrical resistance of platinum. Platinum becomes a better or poorer conductor of electricity as its temperature changes. A *constant-*



WORLD BOOK diagram by Art Grebetz

Most liquid air is manufactured by the Claude process. In this process, an *air compressor* increases the air pressure. The air, heated by compression, is cooled slightly in the *heat exchanger.* The air then enters *expansion engines,* which greatly reduce its temperature. Some of the air liquefies as it flows through the expansion valve.

volume gas thermometer measures the effect of temperature on the pressure of a gas kept at a certain volume. Such gases as helium or neon are used to measure the temperature of liquid air because they turn into liquid at lower temperatures than air does.

Nitrogen and oxygen, the two major parts of air, can be separated and used in their liquid form by distilling liquid air (see **Distillation**). When liquid air is heated, the nitrogen turns into a gas before the oxygen does because the boiling point of nitrogen is lower. After the nitrogen has been removed, the remaining substance consists mostly of liquid oxygen. The high oxygen content of the undistilled liquid could cause an explosion if a flammable material came in contact with it.

Making liquid air. The process of making liquid air is based on the fact that compressed air becomes cooler when it expands. This cooling effect was described in detail in 1853 by two British physicists, James Prescott Joule and William Thomson, and it later became known as the *Joule-Thomson effect.* In 1877, Louis-Paul Cailletet, a French physicist, liquefied air for the first time.

In 1895, the German chemist Carl von Linde invented a commercial process for liquid air production based on the Joule-Thomson effect. Linde's method is still used today but with many improvements. Compressors raise the air pressure in a chamber to about 3,000 pounds per square inch (20,600 kilopascals). Compression heats the air, and so water jackets on the compressor, plus a device called a *heat exchanger,* are used to lower the compressed air's temperature before it becomes liquefied.

There are two ways to liquefy air. In one method, called *Joule-Thomson expansion,* the compressed air flows through a series of throttling valves into increasingly larger chambers. The pressure and temperature of the air decrease in each chamber as the air expands. In the final chamber, some air has become cold enough to condense into liquid. The cold vapor from this chamber is circulated around the other chambers to help cool the air that is still going through the liquefying process.

In 1902, Georges Claude, a French engineer, developed the second method of liquefying air. It resembles Joule-Thomson expansion but is more efficient because it makes use of work done by expanding air. In the Claude method, compressed air enters a chamber and pushes a piston as it expands. As the piston moves, the volume of the chamber increases, and the chamber's air pressure and temperature decrease. The air is sent through a series of these piston-equipped chambers, called *expansion engines,* until it becomes liquid.

Special containers called *Dewar flasks* protect liquid air from heat and evaporation. A Dewar flask is a bottle made of two layers of glass. There is space between the layers of glass to insulate the contents. The flask may be coated with silver to reflect heat. Large quantities of liquid air for industrial use are stored in huge insulated tanks. John B. Butt

Liquid crystal is a substance that can flow like a liquid, yet has properties that are characteristic of a solid crystal. The most common use of liquid crystals is in liquid crystal displays (LCD's). Those displays range from small units for watches, calculators, cellular telephones, and handheld computers called *personal digital assistants* (PDA's) to large displays for automobile dashboards, computer screens, and television sets.




J. R. Eyerman

Liquid crystals painted on a man's hand, *left,* show areas of different temperatures as different colors. Blue is the warmest area, green cooler, and red coolest. The color change to green, *right,* indicates that the temperature of the hand has dropped.

The most useful property shared by solid and liquid crystals is the arrangement of the tiny particles of which they are composed. In a solid crystal, the particles are atoms, and the atoms are aligned with one another. In a liquid crystal, the particles are molecules, and normally

the molecules are lined up—though not as uniformly as in a solid crystal.

A unique property of liquid crystals enables scientists and engineers to make use of their molecular alignment. The alignment can be disrupted electrically, magnetically, or by a temperature change. A crystal that is normally clear becomes murky. A colored crystal changes color.

An LCD uses voltage to disrupt the alignment. The display consists of many small *pixels* (picture elements). Each pixel is made up of many liquid crystals that are normally clear. Applying a small voltage to a pixel disrupts the alignment of its liquid crystal molecules. The pixel can become black or various shades of gray.

In a color LCD, light from the liquid crystal passes through filters that produce the colors. Liquid crystal thermometers use crystals that change color as their temperature varies. Julia E. Fulghum and Linli Su

See also **Thermometer** (Liquid crystal thermometers; with illustration); **Watch** (Electronic watches).

Liquid measure. See **Weights and measures.**

Liquor. See **Alcoholic beverage; Distilling.**

Liquor law. See **Local option.**

Liquorice. See **Licorice.**

Lira, *LIHR uh,* is a unit of money in Turkey. It was also the currency of Italy until 2002. The word comes from the Latin term *libra,* meaning *pound.* The Italian lira was replaced by a new currency, called the euro. See also **Euro.**

Lisbon (pop. 663,315) is the capital and largest city of Portugal. About a fifth of the nation's people live in the Lisbon area. The name of the city in Portuguese is *Lisboa.* Lisbon lies in southwestern Portugal at the *estuary* (mouth) of the Tagus River (see **Portugal** [political map]). The estuary empties into the Atlantic Ocean about 10 miles (16 kilometers) west of the center of the city. Lisbon is a major port and the political, economic, and cultural center of Portugal.

The city covers 32 square miles (84 square kilometers). It overlooks the Tagus estuary, which is one of Europe's most important natural harbors. The 25th of April Bridge, one of the longest suspension bridges in the world, extends 3,323 feet (1,013 meters) over the Tagus River.

Downtown Lisbon is a low, flat district next to the harbor known as the *Baixa.* Most of Lisbon's finer shops are located in the Baixa. The rest of the city is hilly, with commercial, industrial, and residential districts.

Lisbon has many public squares, statues of national heroes, treelined avenues, and small parks. Most people live in pastel-colored houses and apartment buildings. Many tourists visit the São Carlos Opera House and the Castle of São Jorge, once the home of Portugal's kings. Another attraction is the Tower of Belém, built in the early 1500's to honor Portuguese explorer Vasco da Gama. Lisbon has several universities, including the University of Lisbon and the Technical University. Portugal's national library is in the city.

Economy. Large shipments of Portuguese ceramics, cork, sardines, tomato paste, and wine are exported from Lisbon's harbor. One of Europe's chief shipyards is located across the Tagus from Lisbon. Portugal's chief banks, insurance companies, and investment firms are in Lisbon. An international airport and major railroad lines serve the city. Public transportation in Lisbon includes buses, electric trains, streetcars, and a subway system.

History. In ancient times, the Greeks, Carthaginians, and Romans colonized Lisbon. The Visigoths captured Lisbon from the Romans during the A.D. 400's, and north African Muslims called *Moors* seized it during the 700's. In 1147, Christian forces led by Afonso I, the first king of Portugal, retook the city from the Moors.

Lisbon became the official capital of Portugal in the late 1200's. During the 1400's and 1500's, the city served

Portuguese National Tourist Office

Dom Pedro IV Square, popularly known as the Rossio, is a center of activity in Lisbon. A monument to Pedro IV, the first emperor of Brazil, stands in the middle of the square. The Rossio lies in an area of Lisbon called the *Bairro Alto,* which has many cafes, shops, and nightclubs.

as headquarters for the explorers and adventurers who established Portugal's empire in Africa, Asia, and South America. In 1755, an earthquake destroyed about two-thirds of Lisbon and killed more than 60,000 people. The Baixa was built as part of the reconstruction of the city.

During World War II (1939-1945), Lisbon became a center of international political activity because it was a neutral city. On April 25, 1974, a military revolt in Lisbon overthrew the dictatorship that had ruled Portugal since 1926.

In 1998, Lisbon held a world's fair called Expo '98 that attracted millions of visitors. Douglas L. Wheeler

See also **Portugal** (pictures).

Lisgar, *LIHS gahr,* **Baron** (1807-1876), a British administrator, served as governor general of Canada from 1869 to 1872. He played an important advisory role in stopping the uprising known as the Red River Rebellion (1869-1870). While he was governor general, Manitoba and British Columbia became Canadian provinces. Plans were begun in 1871 to build a railway across the entire country. The Treaty of Washington, signed in 1871, ended quarrels between the United States and the United Kingdom about fishing rights in Canadian waters.

Lisgar was born in Bombay (now Mumbai), India. His given and family name was John Young. He was elected to the British Parliament in 1831. Lisgar became chief secretary for Ireland in 1852, lord high commissioner of the Ionian Islands in 1855, and governor general of New South Wales in 1861. He was knighted in 1855 and became the first Baron Lisgar in 1870. Jacques Monet

Lisping is a type of speech problem. People who lisp have difficulty pronouncing *sibilant* (hissing) sounds, such as *s* or *z.* They may substitute other sounds or distort these sounds. For example, in the sentence "I see my sister," a person who lisps may substitute *th* for the *s* sounds and say "I thee my thithter." Another person who lisps may distort the *s* into a whistling sound instead of the normal hiss.

Many children lisp when they first begin to speak. During normal speech development, most children master the hissing sounds long before school age. But sometimes a child's speech development may be delayed. Various things can cause such delays. Among these may be loss of hearing and defects of mouth structures, particularly the tongue, teeth, and palate. Almost all children lisp when they lose their primary front teeth (see **Teeth**). Improper speech habits of parents may also delay a child's speech development.

When lisping results from structural problems, the structures usually must be corrected before completely normal speech can be produced. Speech-language pathologists, who are specially trained to treat speech and language disorders, teach people who lisp to speak correctly. The pathologist trains individuals to recognize their own speech errors and then to form the sounds properly. Russell L. Malone

See also **Speech therapy**.

List system. See **Proportional representation**.

Lister, Sir Joseph (1827-1912), founded antiseptic surgery. Before his time, the most trivial operation was likely to be followed by infection, and death occurred in up to 50 percent of all surgical cases.

After Louis Pasteur discovered that bacteria caused fermentation, Lister in 1865 realized that the formation of pus was also due to germs. At first, he used carbolic acid sprays to kill germs in the air, but later he realized that germs were also carried by the surgeon's hands and instruments. He insisted on the use of antiseptics on hands, instruments, and dressings, as well as on the patient. He also introduced catgut ligatures in 1880.

Lister's application of antiseptics so revolutionized surgery that its whole history can be divided into two periods, pre-Listerian and post-Listerian. The use of Lister's techniques virtually eliminated post-surgical infections.

Lister was born at Upton, Essex, and studied medicine at University College, London. He served as professor of surgery at Glasgow University, Edinburgh University, and at King's College, London. He was also surgeon to Queen Victoria. He was made Baron Lister of Lyme Regis in 1897, thus becoming the first medical man to be elevated to the British peerage. Audrey B. Davis

See also **Antiseptic; Semmelweis, Ignaz P.**

Listeria, *lihs TIHR ee uh,* are a kind of bacteria that can cause food poisoning in human beings. The organism's full scientific name is *Listeria monocytogenes.* Illness caused by the bacteria is called *listeriosis.* Most outbreaks of listeriosis occur when people eat precooked products, such as hot dogs or cold cuts, that have been contaminated after processing. Pregnant women, older adults, and people with weakened immune systems can become seriously ill by eating foods contaminated with *Listeria.* Health officials recommend that people who are at risk from listeriosis avoid certain foods and only eat meat products that are thoroughly cooked.

Listeriosis is characterized by mild flulike symptoms, such as fever, chills, and occasionally nausea or diarrhea. If the bacteria spread to the nervous system, headache, neck stiffness, loss of balance, or convulsions can occur. During pregnancy, *Listeria* can be transmitted from the mother to the fetus and cause *miscarriage* (premature birth) or other serious health problems for newborn babies. Most deaths from listeriosis occur among fetuses and newborn babies.

Listeria are common bacteria often found in soil and water. Farm animals can carry *Listeria* in their intestines without becoming sick and can contaminate meat and dairy products. Vegetable crops can be contaminated if manure from infected animals is used as fertilizer. *Listeria* can survive and grow in refrigerators, where they may contaminate leftover cooked foods. The bacteria are killed by heat and thorough cooking.

Dean O. Cliver

Liszt, *lihst,* **Franz,** *frahnts* (1811-1886), was a Hungarian pianist, composer, and teacher. He wrote many works for the piano and orchestra, and was the most celebrated concert pianist of the 1800's. He performed an invaluable service to music as the teacher and sponsor of most of the brilliant musicians of his time.

His life. Liszt was born in Raiding, Hungary (now part of Austria). His father, a talented amateur musician, was his first piano teacher. The boy's musical talent appeared early. By the time he was 12, he had been presented in Austria, Germany, and Hungary as a child prodigy at the piano. In 1823, Liszt went to Paris, where he studied music theory and composition privately. The French music world recognized Liszt as a brilliant performer with an almost uncanny ability to improvise on the keyboard. He

had once wanted to become a priest, but instead decided to follow a career in music. He was inspired by the success of Niccolò Paganini to become as much a master of the piano as Paganini was of the violin.

Liszt quickly became a favorite of intellectual and artistic circles in France, not only because of his talent but also because of his fascinating personality. In addition, his popularity was enhanced by his generosity, his fine family background, and his ability as a writer and critic.

In the early 1830's, Liszt came to know many influential people in the artistic and literary circles of Paris. He met Niccolò Paganini, the pianist Frédéric Chopin, and the composer Hector Berlioz. He also met the Countess Marie d'Agoult, who was his mistress from 1835 until 1844. Liszt was romantically involved with many women during his life, including the writer George Sand and the Princess Carolyne von Sayn-Wittgenstein.

Liszt made triumphal tours throughout most of Europe as a concert pianist. In 1848, he retired to the German Duchy of Weimar, where he had been appointed in 1842 as court music director. In Weimar, he began his productive and successful career as a composer. He also conducted opera performances and orchestral concerts and helped to make Weimar a major center for music. He sponsored the work of Richard Wagner and his new concept of musical theater (see **Wagner, Richard**). While at Weimar, Liszt premiered Wagner's *Tannhäuser* and *Lohengrin*. He also produced *Benvenuto Cellini*, an opera by Hector Berlioz, as well as many other works.

While the Princess Carolyne von Sayn-Wittgenstein lived with Liszt at Weimar, she strongly influenced his career as a composer. But in 1858, Liszt resigned his post at Weimar. He went to Rome in 1861. In 1865, Liszt took the vows of the four minor orders of the Roman Catholic Church and received the title of Abbé, but he never became a priest. In his later years, Liszt divided his time between Rome, Weimar, and Budapest, and taught piano and composition. In 1886, Liszt toured Europe, attending concerts presented in honor of his 75th birthday. He died at Bayreuth.

His works. Liszt composed a great number of important works for the piano. He wrote two complete concertos for piano and orchestra and an unfinished third piano concerto. For solo piano, Liszt wrote one grand sonata, several sets of variations, and numerous shorter works, including ballads, études, rhapsodies, and waltzes. He expanded the boundaries of piano technique with broadly sweeping scales and arpeggios, rapid changes of register, unusual divisions of the beat, extremes of tempo and dynamics, and dense chordal textures.

Liszt wrote two symphonies for orchestra, the *Faust Symphony* (1857) and the *Dante Symphony* (1857). He also wrote 13 symphonic poems, which he preferred to call "tone poems." *Les Préludes* (1848, revised before 1854) is the best known of his symphonic poems.

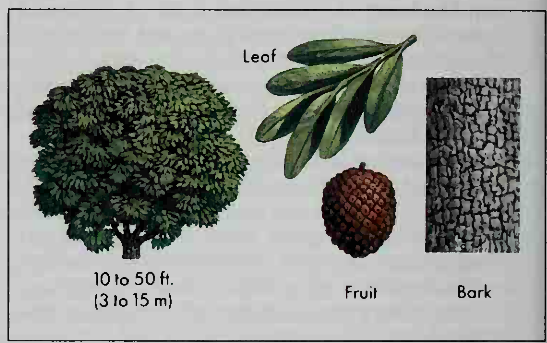
Liszt's works include a large number of choral compositions, many of them sacred works. He also wrote many songs for solo voice and piano. In addition, Liszt composed a number of pieces for organ.

Liszt transcribed many orchestral works so that they could be played by two-hand or four-hand piano. His transcriptions of Beethoven's symphonies made it possible to play and hear them in the intimacy of private homes as well as in large concert halls. Liszt also transcribed organ works by Johann Sebastian Bach and violin études by Paganini. Daniel T. Politoske

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Litchi, *LEE chee,* is an evergreen tree that bears red fruit. Its name is also spelled *leechee, liche, lichi, litchee,* and *lychee.* The litchi originated in southern China, where it has been cultivated for its fruit for over 2,000 years. Litchis also are grown commercially in Australia, India, South Africa, Florida, and Hawaii.



WORLD BOOK illustration by John D. Dawson

The litchi is an evergreen tree that grows in warm climates. The tree bears clusters of bright red fruits also called litchis.

The litchi fruit is round and ranges from $\frac{1}{2}$ inch to $1\frac{1}{2}$ inches (1.3 to 3.8 centimeters) in diameter. It has rough, papery red skin and juicy, white flesh with a single brown seed. The fruit is rich in vitamin C. It usually is eaten fresh but may be canned in light syrup. The fruit also may be dried like raisins. When prepared this way, it is called *litchi nut.*

Litchi trees grow best in subtropical areas in deep, well-drained soil. They may grow up to 50 feet (15 meters) high. Philip J. Ito

Scientific classification. The litchi belongs to the soapberry family, Sapindaceae. It is *Litchi chinensis.*

Liter, *LEE tuhr,* is a commonly used measure of capacity and volume in the metric system. It is also spelled *litre.* The official unit for volume in the metric system is the cubic meter, but most people use the liter instead. Since 1964, a liter has been defined as exactly one cubic decimeter, or 1,000 cubic centimeters. One liter contains 61.024 cubic inches and equals 1.057 liquid quarts. Its symbol is *l.* Richard S. Davis

See also **Weights and measures; Metric system.**

Literacy, *LIHT uhr uh see,* is the ability to read and write. People who cannot read and write are called *illiterate.* The term *literacy* also refers to the possession of enough reading and writing ability to function in soci-

Literacy rates for selected countries

This table shows the percentage of people in various countries who can read and write. Most countries report literacy rates for people 15 years old and older, but a few countries use other age groups. Methods used to determine literacy also vary from country to country.

Country	Literacy rate
Africa	
Algeria	62
Angola	41
Benin	37
Burkina Faso	19
Burundi	35
Cameroon	63
Central African Republic	34
Chad	48
Congo (Brazzaville)	75
Congo (Kinshasa)	77
Egypt	51
Ethiopia	35
Gabon	63
Ghana	64
Guinea	36
Ivory Coast	40
Kenya	78
Liberia	38
Libya	76
Madagascar	46
Malawi	56
Mali	31
Mauritania	38
Morocco	44
Mozambique	40
Namibia	76
Niger	14
Nigeria	57
Africa (cont.)	
Rwanda	60
Senegal	33
Sierra Leone	31
South Africa	82
Sudan	51
Swaziland	67
Tanzania	68
Togo	52
Tunisia	67
Uganda	62
Zambia	67
Zimbabwe	85
Asia	
Afghanistan	31
Bangladesh	38
Bhutan	42
Cambodia	65
China	82
India	52
Indonesia	84
Iran	72
Iraq	71
Israel	96
Japan	99
Jordan	86
Korea, North	97
Korea, South	98
Asia (cont.)	
Kuwait	79
Lebanon	92
Malaysia	85
Myanmar	83
Nepal	38
Pakistan	38
Philippines	95
Saudi Arabia	71
Singapore	91
Sri Lanka	90
Syria	80
Tajikistan	98
Thailand	94
Turkey	82
Vietnam	94
Yemen	37
Europe	
Albania	93
Austria	99
Belarus	99
Belgium	99
Bulgaria	98
Croatia	98
Denmark	99
Finland	*
France	99
Georgia	99
Europe (cont.)	
Germany	99
Greece	95
Hungary	99
Ireland	98
Italy	97
Netherlands	99
Norway	99
Poland	99
Portugal	88
Romania	98
Russia	98
Spain	97
Sweden	99
Switzerland	99
Ukraine	98
United Kingdom	99
North America	
Canada	97
Costa Rica	95
Cuba	96
Dominican Republic	82
El Salvador	71
Grenada	95
Guatemala	64
Haiti	45
Honduras	73
North America (cont.)	
Mexico	90
Nicaragua	66
Panama	91
Trinidad and Tobago	98
United States	97
Pacific Islands and Australia	
Australia	*
New Zealand	99
Papua New Guinea	72
South America	
Argentina	91
Bolivia	83
Brazil	83
Chile	95
Colombia	91
Ecuador	90
Paraguay	92
Peru	89
Suriname	93
Uruguay	97
Venezuela	93

*More than 99 percent.
Figures are estimates for 1996 and earlier years.
Sources: United Nations Educational, Scientific, and Cultural Organization; U.S. Central Intelligence Agency.

ety. People are called *functionally illiterate* if they cannot read or write well enough to carry out activities that are common in the social settings they encounter. Such activities may include employment, schoolwork, voting, or worship.

There are different ways to measure literacy. In one method, people are considered literate if they have completed a certain number of years in school. In another, people's skills are tested to determine whether they are literate or illiterate. The various measures of literacy, however, are not exact and cannot be easily compared.

The spread of literacy in the West. Before the 1400's, the vast majority of people in Europe were illiterate. Most people never had an opportunity to learn to read because there were few schools, and books were scarce and often expensive. Although some people at every level of society could read, most literate people belonged to the upper classes. Illiterate people relied on literate people to read and write for them.

From the 1400's to the 1900's, literacy spread at an uneven rate. Such factors as age, gender, geography, ethnic group, and social class often determined who became literate. Literacy levels varied widely from region to region, even within one country. But certain social and technological changes occurred after 1400 that made literacy possible for more people.

In the 1440's, the German printer Johannes Gutenberg became the first European to print a book from movable type. As a result, reading material was eventually mass-produced in Europe and inexpensive books became more widely available. One of the first books printed in Europe was the Bible. During the 1500's, the Protestant Reformation and Roman Catholic Counter Reformation spurred people's desire to read the Bible for themselves. Scholars translated the Bible into German, English, and several other languages. Many religious leaders taught that every person should learn to read in order to study the Scriptures.

With the spread of commerce and industry during the 1700's and 1800's, large numbers of people migrated to cities to take jobs. Increasingly, people had to read instructions and perform other tasks that required literacy. During the 1800's, printers developed new technologies in mass-production printing. As people moved into cities, they found a widening range of printed materials. In addition, governments began to value educated citizens, and systems of public schooling expanded. By the late 1800's, formal education had become fairly common, and many children were being taught to read in school. As a result of these developments, more people had the opportunity and motivation to learn to read and write, causing the literacy rate to rise rapidly after 1700.

Illiteracy in the United States. People who are literate make up about 97 percent of the adult population of the United States. However, this figure includes some people who can be assumed to be functionally illiterate. The 1990 U.S. census showed that almost 6 percent of people living in the United States who are 15 years old or older had less than an eighth-grade education.

In 1975, a survey by the United States Department of Health, Education, and Welfare estimated that 20 percent of all adults lacked the degree of literacy needed to perform such common tasks as reading a newspaper, balancing a checkbook, and filling out a mail-order form. A 1985 study funded by the U.S. Department of Education showed that about 16 percent of English-speaking Americans between the ages of 21 and 25 could not read well enough to use a street map or to interpret information on a paycheck stub.

Many states, concerned that high schools have allowed functionally illiterate students to graduate, have enacted minimum competency requirements for literacy. Some states now require high school students to pass tests in reading and writing before they graduate. In a number of states, high school students must demonstrate that they are literate enough to read a newspaper advertisement, complete a job application, and perform similar tasks.

Many organizations in the United States work to improve literacy. Since the 1960's, a federal program called Adult Basic Education has helped provide instruction in reading and writing for undereducated adults. In 1970, the U.S. Office of Education (now the Department of Education) started a project, called Right to Read, to improve reading instruction in schools and to encourage instruction of illiterate adults through private organizations. One such organization, Project Literacy U.S. (PLUS), uses television to promote awareness of illiteracy and to encourage action against illiteracy. Other organizations, including Literacy Volunteers of America and Laubach Literacy International, recruit and train large numbers of volunteers to teach reading and writing skills.

Literacy in Canada. Canada does not collect direct statistics on literacy. Rather, census takers ask each person the highest grade completed in school, and that information is used to estimate the nation's literacy rate. The 1991 Canadian census revealed that about 14 percent of the population age 15 or older had less than a ninth-grade education. Some of these people can be assumed to be functionally illiterate. According to UNESCO, an agency of the United Nations, about 3 percent of Canada's adult population is totally illiterate.

The Canadian government's National Literacy Secretariat, part of Human Resources Development Canada, teaches people basic literacy skills and trains them for jobs. The government also cooperates with a number of private literacy agencies. Literacy programs face an extra challenge in Canada because the country has two official languages, English and French.

Literacy in other countries. During the 1900's, especially after 1960, developing countries in Africa, Asia, and Latin America began to recognize that economic and social progress may depend in part on having a literate population. In most cases, a country's citizens must be able to read before the country can modernize its methods of government, industry, farming, and health care.

Many countries have implemented literacy programs that rely on volunteer teachers. In the 1960's, the People's Republic of China recruited about 30 million volunteer teachers with the slogan "You Who Can Read, Teach an Illiterate." In 1961, Cuba temporarily closed its schools and sent its teachers to rural areas to instruct illiterate people. In one year, this campaign increased the country's literacy rate from 75 percent to about 96 percent. Other countries that have reported progress against illiteracy include Brazil, Ghana, Mexico, Tanzania, Turkey, and Venezuela.

The world literacy rate has risen since 1900. In 1950, about 55 percent of the world's population was literate. By 2000, 79 percent was literate. Still, many developed countries have large numbers of functionally illiterate citizens. Most of the world's illiterate people are women because women have fewer educational opportunities than men in many countries. Harvey J. Graff

See also **Reading** (Reading and society); **Writing** (as communication).

Literary awards. See **Caldecott Medal; Governor General's Literary Awards; Laura Ingalls Wilder Award; Newbery Medal; Nobel Prizes; Pulitzer Prizes; Regina Medal.**

Literary criticism. See Criticism.

Literature, in its broadest sense, is everything that has ever been written. It includes comic books and pamphlets on potato bugs, as well as the novels of Mark Twain and the plays of William Shakespeare.

In a narrower sense, there are various kinds of "literatures." For example, we may read literature written in a certain language, such as *French literature.* We speak of the literature of a period, such as *literature of the 1800's.* We also refer to the literature of a subject, as in the *literature of gardening.*

Literature has two main divisions: fiction and nonfiction. *Fiction* is writing that an author creates from the imagination. Authors may include facts about real persons or events, but they combine these facts with imaginary situations. Most fiction is narrative writing, such as novels and short stories. Fiction also includes drama and poetry. *Nonfiction* is factual writing about real-life situations. The chief forms of nonfiction include the essay, history, biography, autobiography, and diary.

Enjoying literature

Why we read literature. We all read for a variety of reasons. These reasons change with our age, our interest, and the literature we read. Our basic reason for reading is probably pleasure. We read literature mostly because we enjoy it.

Reading for pleasure may take various forms. We may read just to pass the time. We often read for information and knowledge. We find pleasure in learning about life in the Swiss Alps or on the Mississippi River. We find possible solutions to our problems when we meet people in books whose problems are like our own. Through literature, we sometimes understand situations we could not otherwise understand in real life.

We also read simply for the enjoyment we get from the arrangement of words. We can find pleasure even in nonsense syllables, just as children like the sound of "Ring Around the Rosie," though they may not know what the words mean.

Judging literature. Reading is such a personal activity that there can be no final rules for judging a piece of writing. The taste and fashion of the times often enter into critical judgments. Some books become best sellers overnight. But their popularity does not necessarily mean that they are great. Other works continue to be important for nonliterary reasons. Many students today read Harriet Beecher Stowe's *Uncle Tom's Cabin* (1851-1852) chiefly for its historical interest.

Yet, readers and critics do agree on certain writings that they consider *classics,* or literature of the highest rank. For example, thousands of stories have been published about young lovers whose parents disapproved of their romance. Most were soon forgotten. But for about 400 years, Shakespeare's *Romeo and Juliet* has been considered a classic story of young love.

Shakespeare used words and phrases that are packed with meaning. But, perhaps more important, Shakespeare gave *Romeo and Juliet* broad human values. These values were not limited to one place or to one time. The characters of the play seem to be real people who face real problems. They express feelings that people anywhere might have at any time.

For the same reasons, the works of a novelist such as Jane Austen mean a great deal to creative readers of any generation. Austen's novels *Pride and Prejudice* (1813) and *Emma* (1816) express lasting truths and show the author's writing skill. These books will probably appeal to readers during the 2000's just as they did to readers in the 1800's.

Every reader is a critic. Even when we say we have no opinion of a book, we are making a judgment. But such a judgment is probably a poor one, based on little thought. Our ability to judge literature intelligently develops as our reading broadens. Our critical skills, like our muscles, develop with use.

The elements of literature

Almost every literary work includes four elements: (1) characters; (2) plot; (3) theme, or statement; and (4) style. A good writer tries to balance these elements to create a unified work of art.

Characters. Writers may want to describe actions or ideas. But they must also describe the characters—the persons or objects—affected by these actions and ideas. The characters make up the central interest of many dramas and novels, as well as biographies and autobiographies. Even a poem is concerned with characters. The speaker, or the poet, is often the main character of a poem. Writers must know their characters thoroughly and have a clear picture of each one's looks, speech, and thoughts.

Motivation means the reasons for a character's actions. Writers must be sure that the motives of their characters are clear and logical. In literature, as in life, character determines action.

Setting is the place in which a character's story occurs. Literary characters, like the persons who read about them, do not exist alone in space. They act and react with one another. They also respond to the world in which they live. Setting is another way of showing people.

Plot tells what happens to the characters in a story. A plot is built around a series of events that take place within a definite period. No rules exist for the order in which the events are presented.

A unified plot has a beginning, a middle, and an end. That is, an author leads us from somewhere (a character with a problem), through somewhere (the character facing the problem), to somewhere (the character overcoming or being overcome by the problem). In literary terms, we speak of a story having an exposition, a rising action, a climax, and a denouement, or outcome. The *exposition* gives the background and situation of the story. The *rising action* builds upon the given material. It creates suspense, or a reader's desire to find out what happens next. The *climax* is the highest point of interest. The *denouement* ends the story.

Theme, or statement, is the basic idea expressed by a work of literature. It develops from the interplay of character and plot. A theme may warn the reader to lead a better life or a different kind of life. It may declare that life is profitable or unprofitable, or that crime does or does not pay.

Serious writers strive to make their work an honest expression of *sentiment,* or true emotion. They avoid sentimentality, which means giving too much emphasis to emotion or pretending to feel an emotion. A writer of honest emotion does not have to tell the reader what to think about a story. A good story directs the reader to the author's conclusion.

Style is the way a writer uses words to create literature. It is one word following another, and one paragraph leading to the next. We can seldom enjoy a story's characters or plot without enjoying the author's style. The way writers write is part of what they have to say. From the first word to the last, a writer must solve problems of style by answering such questions as: "What kinds of words shall I use?" "How shall I present details?" "Should paragraphs be long or short?"

A writer's *point of view,* or the way a story is presented, is another part of style. A writer may tell a story in the first person, using the pronoun I, as though the narrator were a major or minor character in it. Or, the writer may use the third person method, in which the narrator stands apart from the characters and describes the action using such pronouns as *he* and *she.* In the third person *limited* point of view, the narrator describes the events as a single character might see and hear them. In the third person *omniscient,* or all-knowing, point of view, the narrator reports on what several characters are thinking and feeling.

Hollis Summers

Related articles in *World Book.* See *The arts* section of the country articles, such as **Poland** (The arts). See also the following articles.

Literatures of the world

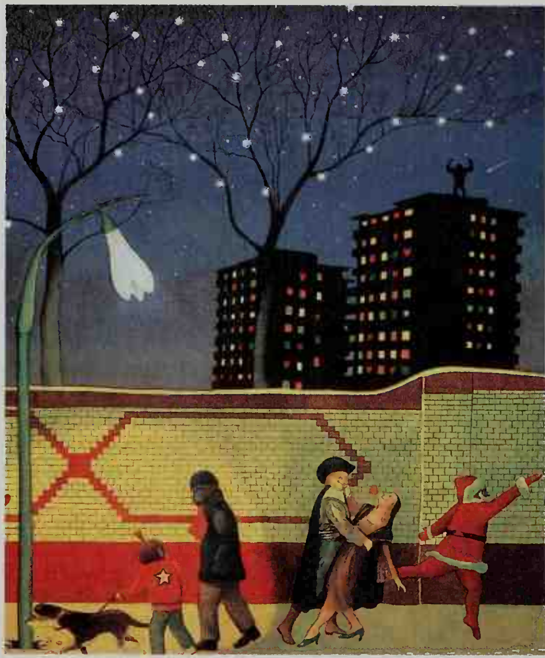
African American literature
American literature
Canadian literature
Chinese literature
English literature
French literature
German literature
Greek literature
Irish literature
Italian literature
Japanese literature
Latin American literature
Latin literature
Russian literature
Sanskrit literature
Scandinavian literature
Spanish literature
Yiddish literature

Forms of literature

Allegory
Autobiography
Ballad
Biography
Burlesque
Criticism
Detective story
Diary
Drama
Epic
Epistle
Essay
Fable
Fiction
Folklore
Ghost story
Gothic novel
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Novel
Nursery rhyme
Parody
Poetry
Prose
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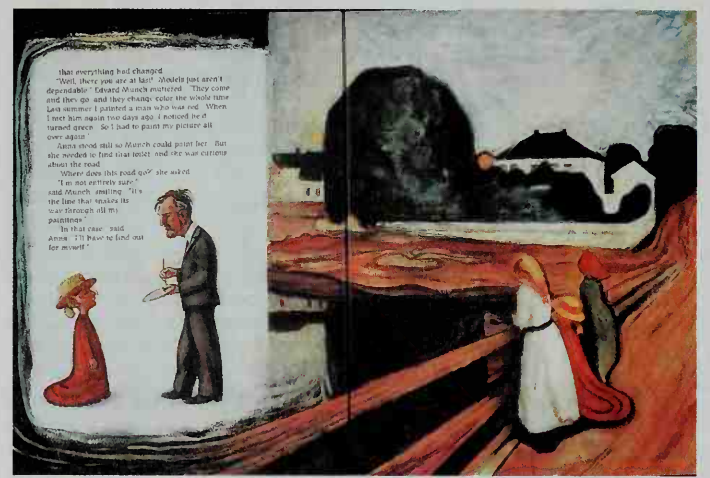
From *Voices in the Park* by Anthony Browne. Published by DK Publishing, Inc. Illustrations copyright © 1998 Anthony Browne. Reprinted with permission.

United Kingdom



Illustration by N. Parker from *The History of the Hoppers* by B. Parker; David Ell Press, Sydney, Australia

Australia



From *Anna's Art Adventure* by Bjorn Sortland. Illustrations by Lars Elling. Copyright © 1993 Det Norske Samlaget. Reprinted with permission.

Norway

Literature for children opens a fascinating world of entertainment and information to young people from toddlers to teen-agers. The books illustrated on this and the opposite page represent the rich variety of attractive and creative works that are available to young readers in many countries from all parts of the world.

Literature for children

Literature for children consists of the huge body of literature that has appeal for individuals from infancy through the teens. Today, young people can choose from thousands of works written and illustrated for them. These works include biographies, novels, poems, collections of folk literature, and books that provide information on the arts, sciences, and social sciences.

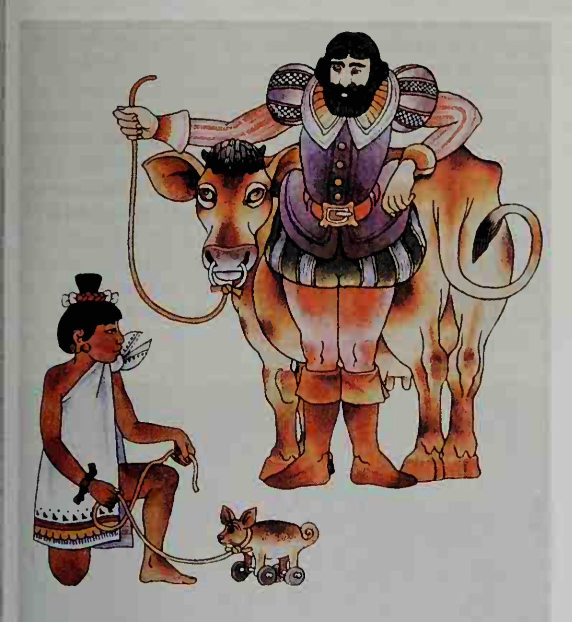
There are many kinds of children's books. Some books take readers to imaginary lands. Others describe children whose experiences resemble those of the readers. Many children's books today discuss difficult problems that face individuals and society. Some children's books satisfy the reader's curiosity about life in other lands, or about the lives of famous men and women. Some fine poetry is written just for children. Children's literature also introduces readers to the wonders of science and the beauty of art.

Ann D. Carlson, the contributor of this article, is Professor in the Graduate School of Library and Information Science at Dominican University.



Illustration by Meshack Asare from *My Name Is Kofi*; by permission of Ghana Publishing Corp. Publishing Division, Tema, Ghana

Ghana



Nacian con pelo, pero después los depilaban untándoles ungüento de trementina. Los criaban como animales domésticos y los hacian engordar. Su carne se vendia en el lianguis. Los españoles la consideraban tan sabrosa que cambiaban piezas de res por esos animalitos. Asi se extinguieron.

Illustration by Felipe Dávalos from *Animales Mexicanos* by Rafael Martin del Campo from *Colibri*, Volume 1; edited by Dirección General de Publicaciones y Bibliotecas, Secretaria de Educacion Pública, México © CONAFE

Mexico



From *The Brave Little Tailor* retold and illustrated by Olga Dugina and Andrej Dugin. Copyright © 1999 by Esslinger Verlag. Reprinted with permission.

Germany



Illustration by the author from *Hiroshima No Pika* by Toshi Maruki; © 1980 by Toshi Maruki. By permission of Lothrop, Lee & Shepard Books (a Division of William Morrow & Co.)

Japan

Illustrations are a special feature of children's literature. In general, children's books emphasize illustrations much more than do books for adult readers. Books written for young children have more pictures than books for older children have. Illustrations frequently contribute as much to the reader's enjoyment as does the text of the book.

The history of children's literature in English dates back to the A.D. 600's. But for about 1,200 years, this branch of literature grew slowly. Before the 1800's, few authors wrote books intended for children. Almost none of those who did attempted to entertain their readers. Instead, most authors wrote to teach children what to believe and how to behave, or to teach such subjects as reading, history, and science.

In the 1800's, talented authors and illustrators began creating children's books intended to entertain rather than just instruct. From that time to the present, the number of books for children has grown steadily. This growth has made literature for children a major industry. Publishing houses now have staffs of editors that specialize in children's books and magazines. Public and



Illustration by the author from *Where the Wild Things Are* by Maurice Sendak; © 1963 Harper & Row, Publishers

Illustrations play an important part in most children's books. A menagerie of monsters in Maurice Sendak's *Where the Wild Things Are, shown here,* brings imaginary creatures to life.

school libraries provide large collections of books and other materials for young people. In many countries, awards are presented annually to authors and artists for outstanding achievements in children's literature.

The first section of this article deals with the various kinds of literature for children. The second section of the article traces the development of literature for young readers. Both of these sections include and describe specific examples of children's literature. The extensive bibliographies at the end of the article list and describe hundreds of additional children's works. The article also includes career information for the reader and some guides to selecting children's books. Reproductions of illustrations created by important artists of children's literature appear throughout the article.

Kinds of children's literature

Literature for children can be divided into five main categories: (1) poetry, (2) folk literature, (3) fiction, (4) biography, and (5) information books. Much folk literature, including ballads and epics, is written in verse. Folk literature in verse is discussed under *Folk literature,* rather than under *Poetry.*

Poetry. Nursery rhymes provide many children with their first contact with literature. These short, simple poems are one of the oldest forms of children's literature. For hundreds of years, adults have entertained children, and children have entertained themselves, by reciting these rhymes.

Some nursery rhymes, including "Itisket, Itasket," were created long ago as parts of children's games. Others, including "Old King Cole" and "Little Jack Horner," may have been based on real people and events. (Details about the development of some nursery rhymes appear in the **Mother Goose** and **Nursery rhyme** articles.) Most young people today know little about the original meanings of nursery rhymes. Even so, the rhymes have many features that make them enjoyable. They are filled with humor, action, entertaining incidents, and—perhaps most importantly for very young children—musical language. Nursery rhymes can also help children learn the days of the week, the months of the year, the alphabet, and how to count.

Children who have outgrown nursery rhymes can find delight in many poems written especially for them. Much of this verse is humorous. One type of humorous children's poetry, called *nonsense verse,* appeals to children because it deals with illogical and silly characters and situations. Two English authors of the 1800's, Lewis Carroll and Edward Lear, were masters of nonsense verse. The American poets Jack Prelutsky and Shel Sil-



Illustration from *Sing to the Sun* © 1992 by Ashley Bryan. Reprinted by permission of HarperCollins Publishers

A collection of poems called *Sing to the Sun* vividly portrays African American and Caribbean island life with colorful and playful illustrations and simple but musical language.

verstein have written many popular collections of amusing poems as well as serious poetry.

Much of the best humorous poetry deals with children and animals. A. A. Milne of England wrote two such collections of verse—*When We Were Very Young* (1924) and *Now We Are Six* (1927).

Much nonhumorous children's poetry sensitively describes the feelings of children and how they see the world around them. For example, Robert Louis Stevenson of Scotland portrayed the world of children of the late 1800's in his classic collection of poems, *A Child's Garden of Verses* (1885). Gwendolyn Brooks of the United States dealt with the modern world of African American children in *Bronzeville Boys and Girls* (1956).

Folk literature includes fairy tales, folk tales, myths, epics, ballads, and fables. Folk literature has existed since prehistoric times. Early peoples handed down their folk literature orally, from generation to generation. Much of this literature was written down only after the invention of printing in the 1400's. As a result, the authorship of much folk literature is unknown or uncertain.

Most folk literature was not created specially for children. However, much of this kind of literature is presented in a direct and simple style that appeals to the young. In addition, children enjoy the action, colorful characters, and humor that is typical of folk literature. Folk literature can inform as well as entertain. A folk tale may tell the reader about the ethical and moral values of the people who produced it. Or, the child may learn how a people explained natural occurrences, such as floods and thunder, before there were scientific explanations.

Fairy tales and folk tales are terms that are often used interchangeably. The terms refer to two different forms of literature, however. Fairy tales concern fairies, elves, pixies, and other imaginary beings with magical powers. Folk tales deal with the legends, customs, superstitions, and beliefs of ordinary people.

Readers can choose from collections of fairy and folk tales from nearly every major culture that has existed. For example, the *Arabian Nights,* which includes such stories as "Aladdin and the Wonderful Lamp" and "The Seven Voyages of Sinbad the Sailor," is a collection of ancient fairy and folk tales from cultures in Asia and North Africa. Jakob and Wilhelm Grimm gathered a famous collection of German fairy and folk tales in the early 1800's. The tales in this collection include "Rumpelstiltskin" and "Hansel and Gretel." Joel Chandler Harris heard many folk tales of African Americans while living on a Southern plantation in the mid-1800's. Harris used these tales in his famous *Uncle Remus* stories. Other American folk tales include the stories about Johnny Appleseed, Paul Bunyan, John Henry, and Pecos Bill.

Some famous writers have been inspired by folk and fairy tale themes to create original stories based on them. The best-known of these writers is Hans Christian Andersen, a Danish author of the 1800's. Andersen wrote some of the most delightful children's classics of all time, including "The Ugly Duckling" and "The Emperor's New Clothes."

Myths. People long ago did not have explanations for such questions as: "What causes thunder and lightning?" "How does the sun rise and set?" and "How did the world begin?" Thus, people developed stories of gods and heroes who controlled natural forces. These stories, called *myths,* were intended to answer basic questions about the world.

Many authors have adapted myths into stories for children. The stories are filled with fantastic adventures, and they provide insight into other cultures.

Epics are long stories about legendary heroes. The epic is a verse form of literature, but versions of epics for children are often adapted into prose. The best-known epics in Western literature, the *Iliad* and the *Odyssey,* are attributed to an ancient Greek poet named Homer. The *Iliad* tells about the last weeks of the Trojan War between Greece and Troy. The *Odyssey* describes the wanderings of the Greek king Odysseus (Ulysses in Latin) as he attempts to return home after the war.

The many epics about the English heroes King Arthur and the Knights of the Round Table also appeal to children. These epics include stories about King Arthur and his magic sword Excalibur, Sir Galahad, Sir Lancelot, and Merlin the magician.

Ballads tell a dramatic story in verse. Like epics, they are often adapted into prose. Early ballads were sung or recited by wandering minstrels. Each generation of minstrels retained the basic outline of its ballads but often included the popular heroes of the day.

Perhaps the most famous hero in ballads is Robin Hood, who lived in Sherwood Forest in England with his band of merry men. Robin Hood was an outlaw, but he was the friend of poor and oppressed people. The character of Robin Hood first appeared in English ballads in the 1300's. Heroes of American ballads include the outlaw Jesse James, the railroad engineer Casey Jones, and "mighty" Casey, a baseball player.

Fables are brief stories that illustrate a moral lesson.

Illustration by Ed Young reprinted by permission of Philomel Books from *Lon Po Po, A Red Riding Hood Story from China* © 1989 by Ed Young

Fairy and folk tales have entertained children of different cultures for hundreds of years. *Lon Po Po* is a modern retelling of the Chinese version of "Little Red Riding Hood."

Most of the characters are animals and objects that talk and act like human beings. These characters symbolize human traits, such as carelessness or wisdom. They act out episodes to prove such proverbs as "Don't count your chickens before they hatch." Many fables criticize human beings and their faults, and are intended for adults. But some fables became children's favorites because of their simple, clear examples of right and wrong and their animal characters.

The most famous collection of fables is *Aesop's fables,* which is attributed to a Greek slave named Aesop who lived about 600 B.C. Jean de La Fontaine, a French author, wrote many delightful and graceful fables in the 1600's. He adapted some of his fables from earlier works. French schoolchildren have memorized La Fontaine's fables for generations.

Fiction makes up one of the largest categories of children's literature. There are many kinds of children's fiction, including: (1) fantasies, (2) adventure stories, (3) stories about animals, (4) stories that describe how people live in other countries, (5) historical fiction, (6) mystery and detective stories, (7) fantasy and science fiction, and (8) realistic fiction. In most children's fiction, the heroes are young people with whom the reader can identify.

Fantasies can be defined as stories that involve beings and events that could not exist in real life. These works may begin realistically but soon turn into stories that could never really happen. The most famous fantasy in children's literature is Lewis Carroll's *Alice's Adventures in Wonderland* (1865). This masterpiece describes the adventures of a girl named Alice, who reaches a magic land after she follows a white rabbit down a hole in the ground. Perhaps the most popular fantasy novel by an American children's author is *The Wonderful Wizard of Oz* (1900) by L. Frank Baum. This book follows the adventures of a girl who has been carried by a cyclone from Kansas to a magic land. A more recent classic, E. B. White's *Charlotte's Web* (1952), tells a tender, humorous story about friendship among animals on a farm.

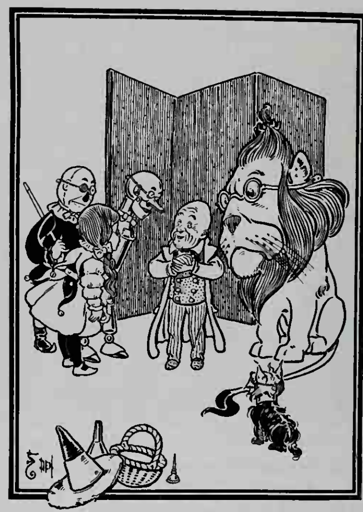


Illustration (1900) by W. W. Denslow from *The Wonderful Wizard of Oz* by L. Frank Baum; Henry Regnery Co.

Fantasies—like *The Wonderful Wizard of Oz*—include thrilling tales of imaginary lands.



Illustration by Nonny Hogrogian reprinted by permission of Philomel Books from *Feathers and Tails* by David Kherdian, illustration © 1992 by Nonny Hogrogian.

Fables are brief stories that teach a moral. Most fables portray animals that act like human beings. *Feathers and Tails* collects a number of fables from cultures throughout the world.

Adventure stories are action-packed tales about daring heroes and cunning villains in fantastic situations. Robert Louis Stevenson's novel *Treasure Island* (1883) is an outstanding example of this popular form of children's literature. The hero is a boy named Jim Hawkins. In a search for buried treasure, Jim and his companions match wits with the pirate Long John Silver, one of the most memorable characters in children's fiction.

Animal stories, like real animals, fascinate many children. Some of the best animal stories stress the affection between animals and human beings. For example, *Shiloh* (1991) by Phyllis Reynolds Naylor describes a mountain boy's love for a dog he is hiding from its cruel owner.

Stories of other countries may satisfy children's curiosity about the way people from other lands live. Such stories help readers recognize the similarities as well as the differences among people. Young readers today can find novels about almost any place in the world. For example, Nancy Farmer's *A Girl Named Disaster* (1996) tells the story of 11-year-old Nhamo, who flees from Mozambique to Zimbabwe to escape an arranged marriage.

Historical fiction covers nearly every period of human existence. The best historical novels combine interesting stories with an accurate description of how people lived at a particular time.

There are historical novels about all periods of world history. Karen Cushman's *The Midwife's Apprentice* (1995) is set in medieval England. James Berry's *Ajeemah and His Son* (1992) is a story about an African father and son who are sold as slaves to separate plantations in Ja-

maica during the 1800's. Karen Hesse's *Out of the Dust* (1997) describes the difficulty of life during the Oklahoma Dust Bowl of the 1930's.

Mystery and detective stories—among the most popular forms of fiction with adult readers—are also enormously popular with young readers. Several outstanding authors have contributed mystery and detective stories to children's literature. In many such stories, young people are the chief characters. For example, in *The House of Dies Drear* (1968) by Virginia Hamilton, a 13-year-old boy finds a buried treasure near a mysterious old house.

Fantasy and science fiction first gained great popularity among young readers during the mid-1900's and continues today. This imaginative form of literature describes adventures in both fantastic and probable settings. J. K. Rowling's *Harry Potter and the Sorcerer's Stone* (1998), published in the United Kingdom as *Harry Potter and the Philosopher's Stone,* is the first book in a best-selling English fantasy series about a boy who discovers he has a wizard's powers.

Realistic fiction. Some modern children's fiction deals with serious problems and situations with a realism seldom attempted before the 1960's. For example, in *Somewhere in the Darkness* (1992) by Walter Dean Myers, an African American boy living with his grandmother is persuaded to join his father, who has just been released from prison. Paula Fox's *Monkey Island* (1991) describes a homeless 11-year-old boy who is befriended by two homeless men who help him survive the streets of New York City. Carolyn Coman's *What Jamie Saw* (1995) deals realistically with child abuse.

Biography introduces young readers to the lives of important men and women. Through biographies, children can learn about people who have made great discoveries, changed the course of history, made contributions to the arts, or accomplished unusual deeds of courage or daring. A skillful biographer can make the life of a real person as exciting as the life of a fictional hero or heroine.



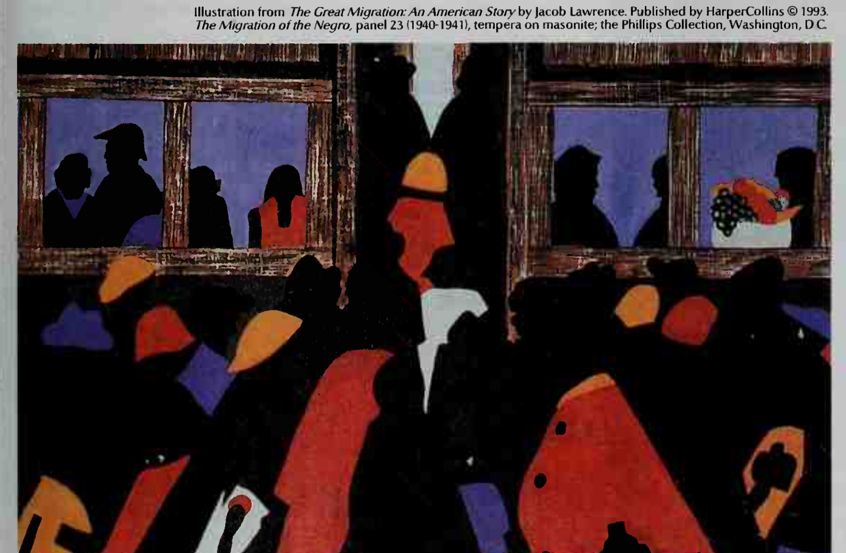
Illustration (1912) by Arthur Rackham; Franklin Watts, Inc.

Aesop's fables is a collection of brief stories that illustrate morals. Most of the characters are animals. One fable tells how a tortoise—through perseverance—beats a hare in a race.

Most authors base their biographies on fact. But they often invent incidents or even dialogue to make the stories more dramatic and lively, especially when they write for younger children. Jean Fritz included humor and accurate detail in a series of biographies set during the Revolutionary War in America (1775-1783).

Information books are nonfiction works that introduce children to the world of learning. The wonders of

Illustration from *The Great Migration: An American Story* by Jacob Lawrence. Published by HarperCollins © 1993. *The Migration of the Negro,* panel 23 (1940-1941), tempera on masonite; the Phillips Collection, Washington, D.C.



A history picture book by the African American painter Jacob Lawrence portrays the migration of African Americans from the South to the North as they sought a better life.



From *Crazy Horse's Vision* by Joseph Bruchac and S. D. Nelson. Text copyright © 2000 Joseph Bruchac. Illustrations copyright © 2000 S. D. Nelson. Published by Lee & Low Books, Inc. Reprinted with permission.

Crazy Horse's Vision is a fictionalized, illustrated biography that focuses on the Lakota Sioux leader Crazy Horse and the Indian chief's journey to adulthood during the mid-1800's.

science, the beauty of art, and the fascination of history unfold in the pages of information books written specially for children. Almost all subjects—such as how Americans elect their presidents, why some animals hibernate, and how religions developed—are treated in these books.

From *Cezanne Pinto: A Memoir* by Mary Stolz © 1994 by Mary Stolz. Reprinted by permission of Alfred A. Knopf, Inc.

A historical novel called *Cezanne Pinto* tells the story of an escaped slave who flees to Canada and eventually becomes a cowboy.

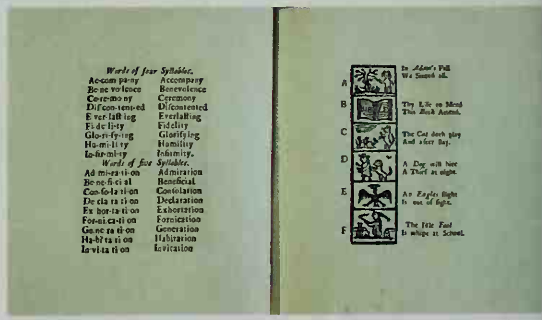
Since the mid-1900's—for the first time—large numbers of information books have dealt with modern problems. For example, Judith Berck's *No Place to Be: Voices of Homeless Children* (1992) describes the troubles of homeless children in the United States. Susan Kuklin's *After a Suicide: Young People Speak Up* (1994) offers true stories told by young people whose family members, friends, and schoolmates have either attempted or carried out suicide.

Many information books focus on ethnic and racial groups. Debbie Holsclaw Birdseye and Tom Birdseye's *Under Our Skin: Kids Talk About Race* (1997) profiles six young people who discuss their ethnic backgrounds and experiences.

History

Adults have told stories to children since prehistoric times. But children's literature written in English first appeared during the A.D. 600's. For hundreds of years, relatively few children's books were produced. Most children's books were lesson books, intended to educate rather than entertain.

During the 1800's, children's literature grew into a dis-



Words of four Syllables.

Ac-com-pa-ny	Accompany
Be-ne-vo-lence	Benevolence
Ce-re-mo-ny	Ceremony
Dif-con-tent-ed	Difcontented
E-ver-laft-ing	Everlafting
Fi-de-li-ty	Fidelity
Glo-ri-fy-ing	Glorifying
Hu-mi-li-ty	Humility
In-fir-mi-ty	Infirmity.

Words of five Syllables.

Ad-mi-ra-ti-on	Admiration
Be-ne-fi-ci-al	Beneficial
Con-fo-la-ti-on	Confolation
De-cla-ra-ti-on	Declaration
Ex-hor-ta-ti-on	Exhortation
For-ni-ca-ti-on	Fornication
Ge-ne-ra-ti-on	Generation
Ha-bi-ta-ti-on	Habitation
In-vi-ta-ti-on	Invitation

A In *Adam's* Fall
We Sinned all.

B Thy Life to Mend
This *Book* Attend.

C The Cat doth play
And after Slay.

D A *Dog* will bite
A Thief at night.

E An *Eagles* flight
Is out of sight.

F The Idle *Fool*
Is whipt at School.

Illustration from the 1727 edition of *The New England Primer;* Newberry Library, Chicago

The New England Primer taught colonial American children the alphabet through crude illustrations and brief rhymes.

tinct branch of literature. In the early 1900's, the first modern biographies and information books for children were published. Today, young readers can choose from thousands of books, ranging from new editions of classics to serious discussions of social problems.

Early children's literature. The first children's books in England were textbooks written during the A.D. 600's. Saint Aldhelm, bishop of Sherborne, probably wrote the first of these books. He wrote in question-and-answer form and in verse. For almost 1,000 years, most English instruction books were written in this style.

John Amos Comenius, a Czech educator, was one of the first authors who believed that children's books should entertain as well as teach. His textbook *Orbis Sensualium Pictus (Visible World,* 1658) was the first children's book in which illustrations played a major part. Comenius stated that he wanted to attract the reader's attention "with pictures that amusingly teach the chief things of this world."

From the 1500's to the early 1800's, inexpensive little books were sold in England. The books contained shortened and often crude adaptations of ancient legends, medieval tales, and ballads. Educated adults considered these books trash, but children loved them.

The Puritans were English Protestants who became a powerful force in England and colonial New England. Puritan authors wrote children's books that reflected the ideals of their religion. In New England, the Puritan minister John Cotton wrote *Spiritual Milk for Boston Babes* (1646), a catechism memorized by generations of children. Another popular Puritan children's book in the colonies was *The New England Primer* (about 1690), compiled by Benjamin Harris, a Boston publisher. The book contained the alphabet, rules for behavior, and stories about Christian martyrs.

John Bunyan, an English Puritan, produced a major work of world literature that became popular with both adults and children. Bunyan's book *The Pilgrim's Progress* (1678, 1684) is an allegory about a man's struggle to get to heaven. But adaptations for children emphasize the man's action-filled travels.

Mother Goose. The first classic of children's literature was *Stories and Tales of Past Times with Morals; or, Tales of Mother Goose.* Published in France in 1697, this book consisted of eight fairy tales collected by Charles Perrault. The tales included "Cinderella," "Little Red Riding Hood," and "The Sleeping Beauty." Beginning in the mid-1700's, editions contained nursery rhymes as well as songs and other material. The rhymes became so popular that the term *Mother Goose* became a general name for nearly all nursery rhymes.

The 1700's. During the 1700's in England, children's literature showed signs of developing as a separate branch of literature. Two masterpieces that became popular with both children and adults were published in England in the early part of the century. They were *Robinson Crusoe* (1719) by Daniel Defoe and *Gulliver's Travels* (1726) by Jonathan Swift.

Robinson Crusoe describes the adventures of a man shipwrecked on an island. The original story includes many philosophical reflections by the author. Children's editions omit these portions of the story and emphasize the hero's ingenious battle for survival.

Gulliver's Travels was the first great fantasy in children's literature. It describes four voyages to imaginary lands made by Lemuel Gulliver, a ship's doctor. Swift intended the book as a satire on the many follies he saw in the human race. But children enjoy the book—usually in adapted form—for its humor and imagination.



Illustration by Kate Greenaway from *Mother Goose* (1881); Frederick Warne & Company, Inc.

Mother Goose fairy tales, rhymes, and songs have charmed young children since the 1700's.

John Newbery of England made major contributions to the development of children's literature during the 1700's. Newbery was one of the first successful English publishers of children's books. In 1744, he published *A Little Pretty Pocket-Book,* "intended for the instruction and amusement" of boys and girls. The book included fables, games, rhymes, and songs. It was one of the first books in English that attempted exclusively to entertain rather than educate young readers. Newbery also published *The History of Little Goody Two-Shoes* (1765), considered the first novel written for children. The novel is attributed to the Irish author Oliver Goldsmith.

The 1800's marked the emergence of children's literature as a branch of literature. Many works of children's literature were written during the 1800's, and, for the first time, American authors contributed important books for young people. The first important illustrators



Illustration for "John Gilpin's Ride" from *R. Caldecott's Picture Book No. 1* (1878); Frederick Warne & Company, Inc.

Great illustrators of the 1800's, including Randolph Caldecott, helped make pictures a major part of children's literature.

of children's books lived during the 1800's.

Collections of tales. Most of the best-known fairy and folk tales were collected and published during the 1800's. Jakob and Wilhelm Grimm of Germany compiled the first great collection, including "Hansel and Gretel." Peter Asbjørnsen and Jørgen Moe collected many Norwegian tales, including "The Three Billy Goats Gruff."

In the United Kingdom, Joseph Jacobs collected many English and Irish folk tales, including "The Story of the Three Little Pigs" and "Jack the Giant Killer." Andrew Lang, a Scottish scholar, compiled 12 books of fairy and folk tales from around the world, beginning with *The Blue Fairy Book* (1889).

Masterpieces of fiction. Many of the classic novels in children's literature were published between 1865 and 1900. Lewis Carroll wrote perhaps the most popular novel in all of children's literature—*Alice's Adventures in Wonderland* (1865). Carroll continued Alice's adventures in the novel *Through the Looking-Glass* (1871).

Mary Mapes Dodge wrote *Hans Brinker; or, the Silver Skates* (1865). This was the first important children's novel by an American that described how people lived in another country. The hero is Hans Brinker, a Dutch boy. The story contains much exciting action, but it was written primarily to introduce readers to the history and customs of the Netherlands.

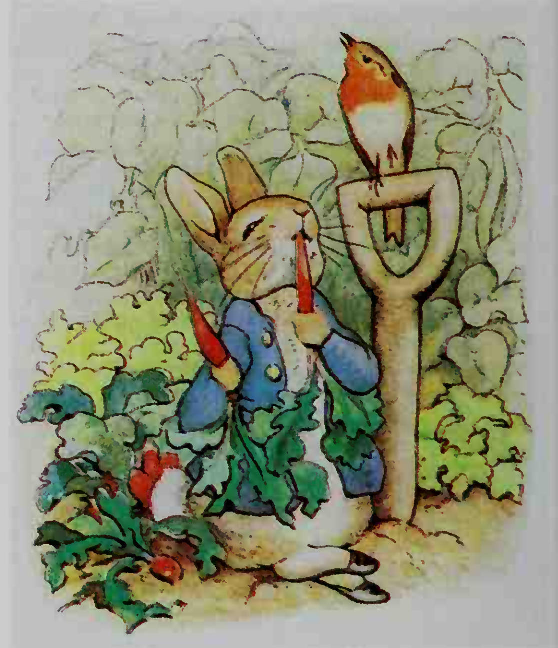
Louisa May Alcott wrote *Little Women* (1868-1869), the first major realistic children's novel about the life of an American family. The story takes place in a small New England community in the mid-1800's. The heroines are the four March sisters—Amy, Beth, Jo, and Meg. The author's realistic yet affectionate treatment of these characters has charmed children for generations.

Anna Sewell, an English author, wrote *Black Beauty* (1877), the first popular realistic novel about animals. The book describes the cruel treatment a horse receives from its masters. The author wrote the book partly as a plea for decent treatment of animals.

Robert Louis Stevenson and the French author Jules Verne produced some of the finest adventure novels in children's literature during the 1800's. Stevenson's *Treasure Island* (1883), *Kidnapped* (1886), and *David Balfour* (1893) all have boys as heroes. These novels show Stevenson's genius at creating colorful characters and breathtaking action and suspense. Verne was the first important author of science fiction. Young people enjoy the imaginative plots and exciting action of such Verne classics as *A Journey to the Center of the Earth* (1864).

Masterpieces of poetry. The first important book of children's verse in the 1800's was *Original Poems for Infant Minds* (1804). The authors were two English sisters, Ann and Jane Taylor. The best-known poem in their book is "Twinkle, Twinkle, Little Star." The American journalist and poet Eugene Field wrote some of the most popular children's poems, including "Little Boy Blue" and "Wynken, Blynken, and Nod." Edward Lear of England composed many books of delightful nonsense verse, beginning with *A Book of Nonsense* (1846). Lear's best-known nonsense poem is "The Owl and the Pussy-Cat" (1871). Lewis Carroll also wrote verse, much of which he included in his "Alice" books.

One popular children's ballad is "An Account of a Visit from Saint Nicholas." It was first published anonymously in an American newspaper in 1823. The poem, which



Frederick Warne & Company, Inc.

The first modern picture book was *The Tale of Peter Rabbit,* one of a series of animal stories written by Beatrix Potter. The author also illustrated the stories with delicate water colors.

begins "'Twas the night before Christmas," remains a familiar part of the Christmas holiday season in the United States. "Casey at the Bat" (1888), a ballad by Ernest Lawrence Thayer, has become part of the folk literature of baseball. The ballad describes how "mighty" Casey struck out in the last inning, thus failing to win a baseball game for his Mudville team.

The rise of illustration. During the 1800's, illustrations became a major part of children's books. For the first time, illustrations were widely used to help young readers visualize the characters and the action of stories and poems. *Alice's Adventures in Wonderland* and *Through the Looking-Glass* contain illustrations by Sir John Tenniel that are among the most famous in all of children's literature. Tenniel's illustrations do much to heighten the humor and absurd situations in Carroll's works. See **Tenniel, Sir John** (picture).

By the mid-1800's, color illustrations appeared widely in children's books. The use of color pictures was partly due to the advances in color printing made by Edmund Evans, an English engraver and printer. Evans engraved and printed the color illustrations of three of the major English children's artists of the 1800's—Randolph Caldecott, Walter Crane, and Kate Greenaway.

Caldecott is best known for his interpretations of scenes of humorous action. Perhaps his most famous illustrations are those published in an 1878 edition of "The Diverting History of John Gilpin" (1782), a ballad by the English poet William Cowper. The ballad describes how elderly John Gilpin tries to stay on a runaway horse. Caldecott's illustrations perfectly capture the frantic, hilarious action of the ballad.

Walter Crane's best illustrations were created for works intended for young children, notably his books of nursery rhymes including *Baby's Opera* (1877) and *Baby's Bouquet* (1878). His work is noted for its delicate colors and attention to details of clothing and objects.

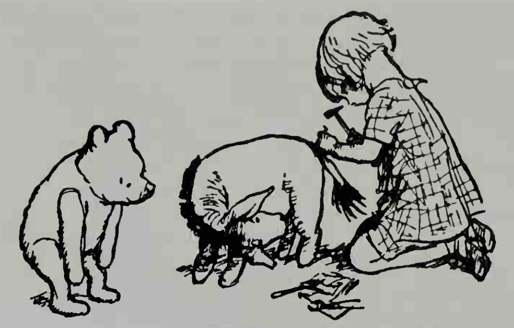


Illustration by Ernest H. Shepard; © 1926, renewed 1954, E. P. Dutton & Co. and McClelland and Stewart Ltd.

Winnie-the-Pooh by A. A. Milne is a famous book about a boy and his adventures with his collection of stuffed toy animals.



Illustration by the author from *The Cat in the Hat* by Dr. Seuss; © 1957 Random House, Inc.

The Cat in the Hat combines fanciful illustrations with simple, clever verse to describe the antics of a fantastic cat.

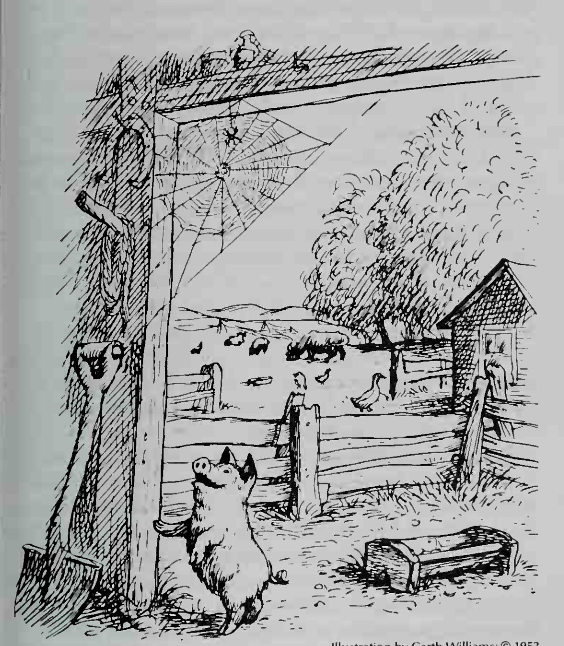


Illustration by Garth Williams; © 1952 Harper & Row, Publishers

Charlotte's Web is a modern children's classic by E. B. White about a farmyard friendship between a spider and a pig.

Kate Greenaway illustrated her own children's poems, including the collection *Under the Window* (1878). Her illustrations portray charming, graceful scenes of happy children and peaceful landscapes.

English artists established children's book illustrations as a distinct art form. But American artists also made important contributions in the late 1800's. Arthur Frost gained fame for his clever and comic pen-and-ink illustrations for Joel Chandler Harris's *Nights with Uncle Remus* (1883). Howard Pyle captured the heroic and romantic spirit of the Robin Hood ballads in his illustrations.

The early 1900's brought new types of children's literature, including a variety of heavily illustrated books called *picture books* and new types of children's nonfiction. The early 1900's also brought big growth in children's magazines.

Picture books were the first important development in children's literature in the 1900's. In these books, illustrations are as important to the reader's enjoyment and understanding of a story as the text. One of the first modern picture books was *The Tale of Peter Rabbit* (1901) by the English author and artist Beatrix Potter. For the 1902 edition, Potter illustrated her simple story with beautiful water colors.

Children's nonfiction. From the 1800's to the 1920's,



Illustration by N. C. Wyeth from *The Boy's King Arthur* edited by Sidney Lanier; © 1917, renewed 1945, Charles Scribner's Sons (collection of Jack Webb, WORLD BOOK photo by E. Cornachio)



Illustration by the author from *Fables* © 1980 by Arnold Lobel. Reprinted by permission of Harper & Row Publishers, Inc.

Great illustrators of the 1900's included N. C. Wyeth and Arnold Lobel. Wyeth became known for his dramatic illustrations of children's classics, such as *The Boy's King Arthur, left.* Lobel gained popularity for his delightful pictures of animals in such books as *Fables, right.*

most of the important children's books were works of fiction or poetry. In 1921, the American historian Hendrik van Loon wrote *The Story of Mankind,* the first significant modern information book. The work traces world history from prehistoric times to the early 1900's. It combines scholarship with a lively writing style then new to children's nonfiction. This book set the example for the interesting, accurate presentation of knowledge that characterizes the best information books.

Until the 1930's, most biographies for children were stuffy and filled with lifeless characters. Then authors began writing biographies that used descriptive detail and dialogue to provide a vivid feeling for the subject and the times in which he or she lived.

Children's magazines had first appeared in the mid-1700's, but they gained new importance in the early 1900's. Perhaps the most influential early children's magazine in the United States was the *St. Nicholas* magazine, published from 1873 to 1943. Under the editorship of Mary Mapes Dodge from 1873 to 1905, the magazine helped upgrade the quality of children's literature. Contributors to *St. Nicholas* included many of the leading children's authors and illustrators of the period.

The oldest important magazine in the United States still being published is *Boy's Life,* started by the national Boy Scouts organization in 1911. A well-known children's magazine used in American schools is *My Weekly Reader,* founded in 1928.

The middle and late 1900's brought the publication of more children's books than ever before. There were several reasons for this enormous growth. Influential theories in education and psychology stressed the importance of children's reading and encouraged parents to help young children to read. Improved printing techniques enabled publishers to produce books that were carefully designed, printed, and illustrated. The number of school libraries and the number of public libraries with departments serving children increased. This support stimulated the publishing of children's books. The expansion of publishing, in turn, led more authors and artists to concentrate primarily on children's literature.

Books for beginning readers became an important element in children's literature in the mid-1900's. The books tell simple stories, often through a carefully restricted vocabulary of words that are easy to read, and with concepts that are easy to understand. Writing under the name of Dr. Seuss, Theodor Seuss Geisel became one of the first authors to create such books. Teachers used many of these books in addition to, or in place of, basic readers to help children learn to read.

New frankness increasingly appeared in children's books. Earlier children's books portrayed adults, especially parents, in an idealized manner. In the middle and late 1900's, many books showed adults as imperfect. One of the first examples was Louise Fitzhugh's novel *Harriet the Spy* (1964). The heroine comments on other characters, both young and adult, with biting frankness. Other books discussed such topics as divorce, alcoholism, homosexuality, and race relations.

The poetry revival. During the early 1900's, publishers issued few books of poetry for children. In the middle and late 1900's, however, many books of poetry for young people were published.

Several children's poets, including David McCord and Eve Merriam, began to win popularity in the mid-1900's. McCord's *Speak Up* (1980) is a collection of witty poems for young children. Merriam's books include the humorous *A Poem for a Pickle: Funnybone Verses* (1989).

New types of children's magazines extended children's literature into millions of classrooms and homes. Dozens of magazines provided young people with fiction, nonfiction, news about current events, games, and puzzles. Notable new children's magazines included *Highlights for Children,* first published in 1946, and

Humpty Dumpty's Magazine, founded in 1952.

In 1967, the National Wildlife Federation (NWF) began *Ranger Rick,* a nature magazine. The NWF later added *Your Big Backyard* and *Wild Animal Babies. Cricket,* founded in 1972, is part of the Cricket Magazine group that includes literary and general information magazines for readers from infancy through young adult.

Stone Soup, founded in 1973, is a magazine that publishes stories, poems, reviews, and drawings primarily by children. In 1975, the National Geographic Society first published *National Geographic World,* a child's version of its adult magazine. The Young Naturalist Foundation introduced *Owl,* a Canadian nature magazine, in 1976. *Cobblestone,* which focuses on American history, began in 1980. In 1980, the Consumers Union of the United States started *Penny Power,* a consumer education magazine for children. In 1990, its name was changed to *Zillions.*

Children's literature today

Today, children's books continue to discuss subjects previously considered too mature for children. Authors write with a new frankness about topics rarely mentioned in earlier children's books. Many works of fiction and nonfiction concern problems of modern life, such as AIDS, child abuse, and violence. For example, the novel *Monster* (2000) by Walter Dean Myers provides a realistic portrait of an African American teen-ager who stands trial accused of participating in a fatal shooting.

Fantasy and science fiction, especially the Harry Potter series, remain hugely popular with young readers. *Harry Potter and the Goblet of Fire* (2000), the fourth book in the series, sold a record 9 million copies its first year.

Other flourishing types of children's literature include poetry and biography. Such poets as Douglas Florian and Naomi Shihab Nye write with freshness and insight about the way the world looks from the viewpoints of children. Examples include Florian's *Mammalabilia: Poems and Paintings* (2000) and Nye's *Come with Me: Poems for a Journey* (2000).

Writers of biographies use lively detail, imaginative dialogue, and rich illustrations to provide a vivid description of the subjects and their times. For example, Andrea Pinkney's *Let It Shine: Stories of Black Women Freedom Fighters* (2000) describes the challenges and triumphs of 10 courageous women.

Careers

Many rewarding careers are open to people who want to make children's literature their life's work. While some people devote themselves to writing or illustrating children's books, many others work as editors or librarians. Editors of children's books and children's librarians provide essential links between the creators of children's literature and the young reader.

Children's editors. Today, editors of children's literature have become an important part of the staff of many publishing houses. Children's editors work with artists and illustrators to produce books. They understand the kinds of books needed in the school curriculum, and they have knowledge of the kinds of books children like and dislike. Other people who work in children's book publishing include art editors and translators.

The Children's Book Council promotes books and reading. It consists of children's book editors and promotion managers. It works with teachers, librarians, and parents to get publicity, sponsor book fairs, arrange book-related programs at conferences, and publish materials. The council sponsors the annual Children's Book Week celebration throughout the United States.

Librarians play many roles in their relations with children. Some librarians work with children from preschool through the elementary grades. Others work mainly with middle and high school readers.

Librarians discuss children's books with authorities and read reviews in professional periodicals. Librarians also read many children's books and hear the reactions of children who have read them. As a result, adults and children can use a librarian's experience and knowledge to help them select suitable books.

Children's librarians. In the late 1800's, public libraries began to realize the importance of having a separate room for children. In the early 1900's, the Carnegie Library School in Pittsburgh, Pennsylvania, offered the first training course for children's librarians. Other library schools quickly recognized the value of such training and offered similar courses. Trained children's librarians were better equipped to understand the development of literature for children and had well-defined standards for judging books. They also had training in storytelling. As these librarians worked with children, they developed methods that had an important influence on the field of children's work in libraries.

Today, there are thousands of library-school graduates working in school libraries and in children's departments in public libraries. They work closely with teachers in developing curriculum and recommending children's books, and they also take books and programs into their communities.

Children's librarians tell stories and they read aloud—often in intimate, informal groups. They also do outstanding work with discussion groups and with children who have hobbies. Through such activities, children's librarians provide an important stimulus to enjoyment and learning through reading.

Young adult librarians. Public library services directed toward teen-agers grew rapidly during the middle and late 1900's. Today, many librarians recognize that readers in middle school and high school have special needs. These readers often consider themselves too old for the children's department, but they also may not feel at home in the adult section. Young adult librarians help such readers bridge the gap.

Trained young adult librarians help readers choose books that will both satisfy their present interests and stimulate new ones. They may organize activities to encourage more and better reading. Librarians provide educational and career information for teen-agers. They also cooperate with schools and local organizations in carrying out programs involving reading.

For more information about the duties of librarians, see the **Library** article.

Selecting children's books

To provide guidance for parents and young people, evaluations of children's books are printed in magazines, newspapers, professional periodicals, and such reference works as *Children and Books* (9th ed., 1997) by



From *The Everything Book* by Denise Fleming. Copyright © Denise Fleming. Published by Henry Holt and Company, LLC. Reprinted with permission.

The Everything Book is a collection of words, numbers, rhymes, and games suitable for infants and toddlers. The book is illustrated with vivid colors and shapes. The collection includes a catchy poem called "Mooly Cow."

Zena Sutherland. Many organizations publish booklists and maintain Web sites devoted to recommending books for young readers. These organizations evaluate the quality of text and pictures and provide information on the recommended age or grade level of books.

In evaluating a book, experts seek answers to many questions. For example, if the book is fiction, do the events arise naturally out of a character's qualities or does the action seem forced? Is the plot interesting and well constructed? Whether fiction or nonfiction, is the book's subject within the child's comprehension? Is the style of writing distinctive and interesting, or commonplace and oversimplified? Is the book's format appropriate in terms of page size, type style, margins, and spacing? Do the illustrations complement the text in both design and subject matter?

Age and grade levels. A person selecting a book for a child should be sure the book generally matches the child's age or school grade. Some experts in children's literature prefer to rate books by grade. They believe that there is a more uniform reading-achievement level among children of a certain grade than among those of a certain age. Other experts prefer to rate children's books on the basis of age. They believe the age level best reflects a child's interests and emotional and social development.

Most book reviews and bibliographies include some recommendation on age or grade level. Usually, the age or grade rating covers a broad period. For example, an age recommendation might run from years 6 through 9, and a grade recommendation from kindergarten through third grade. Ratings should be considered only as a guide, not as a limitation on the use of the book.

Several elements contribute to determining the age or grade level of a book. The most important include sentence length, difficulty of vocabulary, difficulty of concepts, amount of repetition, and subject matter.

Awards provide recognition for outstanding achievements in children's literature. The awards also provide a guide to the finest literature for children.

Frederick G. Melcher, an American publisher, established the two best-known awards in the United States —the Newbery Medal and the Caldecott Medal. Both awards are administered by the Association for Library Service to Children (ALSC) of the American Library Association (ALA). The Newbery Medal, established in 1921, is awarded to the author of the most distinguished contribution to American children's literature during the previous year. The Caldecott Medal, established in 1937, goes to the illustrator of the most distinguished American picture book for children during the previous year. See the articles **Newbery Medal** and **Caldecott Medal** for lists of winners of the medals.

The ALSC also administers the Laura Ingalls Wilder Award. The award, which was first presented in 1954, is given every three years to an author or illustrator for a body of work. Since 1959, the Catholic Library Association has awarded the Regina Medal to honor an individual for a lifetime contribution to children's literature. See **Laura Ingalls Wilder Award; Regina Medal**.

The Coretta Scott King Award was established in 1969 and is given by the ALA. It is presented annually to an African American author and illustrator for an "outstanding inspirational and educational" contribution published during the previous year.

The National Council of Teachers of English founded a poetry award in 1977, and in 1990 the organization presented the *Orbus Pictus Award* for outstanding nonfiction. In 1981, author Scott O'Dell established the Scott O'Dell Award for Historical Fiction.

The National Book Award for Children's Books was awarded from 1969 to 1983. It was resumed in 1996 as the National Book Award for Young People's Literature and includes all types of literature written for children and young adults by U.S. writers. In 2000, the Printz Award was established to recognize excellence in young adult literature. It was named for Michael L. Printz, a school librarian from Topeka, Kansas. It is sponsored by *Booklist*, a publication of the ALA.

The Canadian Association of Children's Librarians established the Book of the Year for Children Award in 1947. The award is given annually to children's books in both English and French.

Other countries award annual prizes, some open to authors and illustrators from any country. The Hans Christian Andersen Award, established in 1956, is given by the International Board on Books for Young People. It is presented every two years to both an author and an illustrator for a lifetime of work in children's literature.

Book reviews of children's literature are printed in general-circulation magazines and newspapers. In addition, five major library periodicals regularly review chil-

dren's books. They are *Booklist,* the *Bulletin of the Center for Children's Books, The Horn Book Magazine, Kirkus Reviews,* and the *School Library Journal.* The ALA publishes *Booklist.* The *Bulletin* is sponsored by the University of Illinois. Private publishers issue *Horn Book, Kirkus Reviews,* and the *School Library Journal.*

Booklists are bibliographies of recommended children's books compiled by various authorities. Most lists are published monthly or annually and are available through the sponsoring organization's Web site. Some lists provide only basic information about a book, including the author and publisher. In other booklists, authorities describe and evaluate the books.

Perhaps the best-known children's booklist is "Notable Children's Books," issued each year by the ALA. The association also publishes "Best Books for Young Adults," an annual list that includes both adult books and books for readers from 12 to 18 years of age.

Many books are intended to help parents aid children with their reading. Betsy Hearne's *Choosing Books for Children* (1999), Eden Ross Lipson's *The New York Times Parent's Guide to the Best Books for Children* (2000), and Betty Carter's *Best Books for Young Adults* (2000) are among the many reasonably priced handbooks that parents can consult.

Some booklists concentrate on titles dealing with racial, ethnic, or gender groups. Isabel Schon's *The Best of the Latino Heritage: A Guide to the Best Juvenile Books About Latino People and Cultures* (1997) and *Black Books Galore!* (1998) by Donna Rand and two other authors deal with recommended books for Latino children and African American children. Kathleen Odean's *Great Books for Girls* (1997) and *Great Books for Boys* (1998) focus on books for the two genders. Other lists may concentrate on a subject. Two examples are Lynda G. Adamson's *Literature Connections to World History, K-6* (1998) and Patricia Pearl Dole's *Children's Books About Religion* (1999). Ann D. Carlson

Books to read

This section contains bibliographies of recommended children's books. The first bibliography, *Infant and toddler books,* lists works best suited to be read to children up to 3 years of age. The next bibliography, *Picture books,* is for children, typically of preschool and kindergarten age, who are ready for longer stories. The next bibliography, *Beginning readers,* also called *Easy-to-read* books, lists books with simple vocabulary, large type, and generally one or more illustrations per page. These books are for children, usually from kindergarten through third grade, who are developing their reading skills. The last bibliography, *Resources about children's literature,* provides suggested reading for adults interested in learning more about children's literature.

The other bibliographies cover various kinds of children's books. Books in these bibliographies are rated in one of three reading level categories: *young readers,* suitable for readers in grades 1 through 3; *intermediate readers,* suitable for readers in grades 4 through 6; and *older readers,* suitable for readers in grade 7 and up. A few books are rated *all ages* because they appeal to many readers at all grade levels. The bibliography *Fiction/Realistic young adult fiction* lists books that explore serious topics in a frank manner for older readers.

The grade level rating of books in the bibliographies is intended merely as a general guide. The ratings should not be considered as a limitation on who should read a book.

The date given for each book is the year in which that particular edition was published. In some cases, the book originally was published much earlier.

This section primarily covers books. However, materials in other formats adapted from children's books are available. Some children's books have been adapted into audio cassettes, videotapes, CD-ROM's, and audio or video compact discs for educational and recreational use. Many children's libraries lend these materials or can provide information on how to obtain them.

Several abbreviations appear often in the booklists that follow. They are *ad.* for *adapter, comp.* for *compiler* or *compiled, ed.* for *edition* or *editor, illus.* for *illustrated, rev.* for *revised,* and *trans.* for *translated* or *translator.*

Infant and toddler books

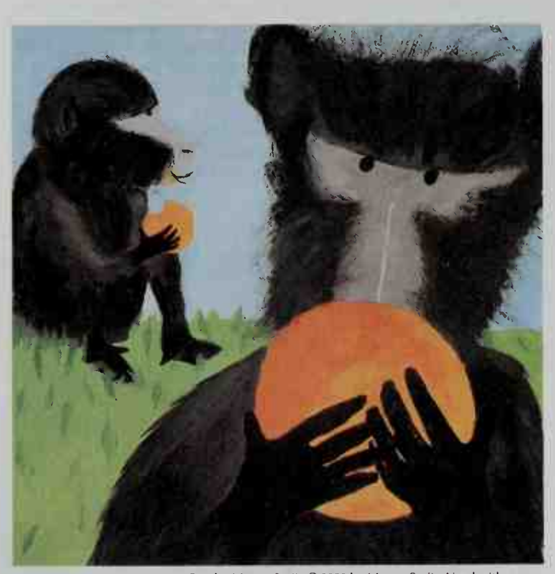
Barton, Byron. *Boats.* HarperCollins. 1998. *Planes.* HarperCollins, 1998. *Trucks.* HarperCollins. 1998. *Trains.* HarperCollins, 1998. All books illus. by the author. Four board books have bold, simple illustrations.

Chorao, Kay. *Knock at the Door and Other Baby Action Rhymes.* Illus. by the author. Dutton, 1999. A collection of finger plays and other action rhymes is accompanied by delicate illustrations and instructions for actions.

Fleming, Denise. *Mama Cat Has Three Kittens.* Illus. by the author. Henry Holt, 1998. Unusual illustrations created by pouring colored cotton pulp through stencils capture the antics of a cat and her three kittens. *The Everything Book.* Illus. by the author. Henry Holt, 2000. A colorful treasury offers rhymes and games.

Hoban, Tana. *Red, Blue, Yellow Shoe.* Photos by the author. Greenwillow, 1986. Clear, colorful photographs introduce the concept of colors.

Hurd, Thacher. *Zoom City.* Illus. by the author. HarperCollins,



From *Rain* by Manya Stojic © 2000 by Manya Stojic. Used with permission of Crown Children's Books, a division of Random House, Inc.

Rain is a picture book that describes how the baboons and other animals on the African savanna exist in harmony with nature, from scorching drought to heavy rain and back to drought.

1998. In a fast-paced board book, cars zoom around with honks and beeps, crashes and repairs.

Martin, Bill, Jr. *Brown Bear, Brown Bear, What Do You See?* Illus. by Eric Carle. Holt, 1992. Different-colored animals describe what they see.

Martin, Bill, Jr., and **Archambault, John.** *Chicka Chicka Boom Boom.* Illus. by Lois Ehlert. Simon & Schuster, 1989. Imaginative verse describes an alphabet that tries to climb a tree.

Miller, Margaret. *Big and Little.* Photos by the author. Greenwillow, 1998. Clear color pictures introduce the concept of size.

Simmons, Jane. *Come Along, Daisy!* Illus. by the author. Little, Brown, 1998. A young duck lags behind her mother and ends up wishing she had "come along."

Picture books

Ackerman, Karen. *Song and Dance Man.* Illus. by Stephen Gammell. Knopf, 1988. Grandpa performs brilliantly when he shows his grandchildren his old vaudeville routine.

Alexander, Lloyd. *The Fortune-Tellers.* Illus. by Trina Schart Hyman. Dutton, 1992. A clever young man becomes a fortuneteller in a witty story that is illustrated with rich color.

Anno, Mitsumasa. *Anno's Alphabet.* Illus. by the author. Crowell, 1975. Letters are shown as woodcarvings. *Anno's Counting Book.* Illus. by the author. Crowell, 1977. An imaginative book introduces numbers.

Bemelmans, Ludwig. *Madeline.* Illus. by the author. Viking, 1963. An independent girl attends a boarding school in Paris.

Browne, Anthony. *Voices in the Park.* Illus. by the author. DK Ink, 1998. A trip to the park is described from the points of view of four different characters.

Day, Alexandra. *Follow Carl!* Illus. by the author. Farrar, 1998. Charming illustrations depict the fun that results when children make a good-natured dog the leader in their game of follow-the-leader. Part of a realistic series about Carl the dog.

Falconer, Ian. *Olivia.* Illus. by the author. Atheneum, 2000. A high-spirited preschool pig is good at many things, especially at wearing others out.

Gág, Wanda. *Millions of Cats.* Illus. by the author. Coward, 1928. An old man and an old woman want only one cat but end up with millions of cats.

Hall, Donald. *Ox-Cart Man.* Illus. by Barbara Cooney. Viking, 1979. A picture story portrays rural life in New England in the early 1800's.

Henkes, Kevin. *Lilly's Purple Plastic Purse.* Illus. by the author. Greenwillow, 1996. Engaging pictures reflect a warm story in which Lilly and her teacher learn to communicate.

Hughes, Shirley. *The Big Alfie Out of Doors Storybook.* Illus. by the author. Lothrop, 1992. Realistic pictures illustrate a collection of stories and poems about the antics and thoughts of a delightful young boy.

Keats, Ezra Jack. *The Snowy Day.* Illus. by the author. Viking, 1962. An African American boy named Peter plays in the first snowfall of the season in the first book of a series.

Leaf, Munro. *The Story of Ferdinand.* Illus. by Robert Lawson. Viking, 1936. A famous story portrays a bull who would rather smell fragrant flowers than fight.

McCloskey, Robert. *Make Way for Ducklings.* Illus. by the author. Viking, 1941. An amusing tale relates the adventures of a family of mallard ducks searching for a home in Boston.

Potter, Beatrix. *The Tale of Peter Rabbit.* Illus. by the author. Warne, 1902. A classic picture book describes the adventures of a mischievous rabbit.

R. Caldecott's Picture Book No. 1. Illus. by Randolph Caldecott. Warne, 1906. This is the first of four collections of poems illustrated by the famous English children's artist.

Rey, H. A. *Curious George.* Illus. by the author. Houghton, 1941. A small monkey and his friend, the man with the big yellow hat, begin their adventures in the first book in a series.

Say, Allen. *Grandfather's Journey.* Illus. by the author. Houghton, 1993. A tender story describes a grandfather who missed Japan when he moved to the United States and remembered America with affection when he returned to his homeland.

Scieszka, Jon. *The Stinky Cheese Man and Other Fairly Stupid Tales.* Illus. by Jon Scieszka and Lane Smith. Viking, 1992. Innovative pictures and a witty text create a humorous retelling of traditional tales.

Sendak, Maurice. *Where the Wild Things Are.* Illus. by the author. Harper, 1963. A boy—sent to his room for being too wild—imagines he is on an island where wild creatures crown him king. *Outside Over There.* Illus. by the author. Harper, 1981. A romantic and beautifully illustrated fantasy describes a girl's love for her baby sister.

Shannon, David. *No, David!* Illus. by the author. Blue Sky Pr., 1998. A spirited young boy's activities meet with parental disapproval, but the boy himself is met with love. *David Goes to School.* Illus. by the author. Blue Sky Pr., 1999. The irrepressible David romps his way through a school day.

Soto, Gary. *Too Many Tamales.* Illus. by Ed Martinez. Putnam, 1993. A young girl believes that she has lost her mother's ring while preparing tamales.

Steig, William. *Doctor De Soto.* Illus. by the author. Farrar, 1982. The world-famous dentist mouse and his helpful wife cleverly stay out of danger as they pull the aching tooth of a fox.

Stevenson, James. *"Could Be Worse!"* Illus. by the author. Greenwillow, 1977. Two young children have fun turning their grandpa's favorite phrase around on him in one of more than a dozen titles featuring the family.

Stojic, Manya. *Rain.* Illus. by the author. Crown, 2000. The animals of the hot, dry African savanna use their senses to predict the coming of, and enjoy the results of, a rainstorm.

Van Allsburg, Chris. *Jumanji.* Illus. by the author. Houghton, 1981. In an imaginatively illustrated story, two children find and play a jungle game that comes to life in their home. *The Polar Express.* Illus. by the author. Houghton, 1985. Imaginative paintings illustrate a Christmas fantasy.

Wells, Rosemary. *Bunny Cakes.* Illus. by the author. Dial, 1997.

From *The Fortune-Tellers* by Lloyd Alexander. Illustration by Trina Schart Hyman. © 1992 by Trina Schart Hyman. Used by permission of Dutton Children's Books, a division of Penguin USA Inc.



The Fortune-Tellers is a fantasy set in the African nation of Cameroon. The main characters are an old fortuneteller and a young carpenter who dreams of power, riches, and romance.



© 1962 The Viking Press, Inc.

The Snowy Day describes a boy's joy and wonder at seeing the season's first snowfall. Author-artist Ezra Jack Keats creatively combined collage and water colors in illustrating this picture book.

Rabbits Max and Ruby create two very different cakes for their grandmother's birthday in one of a series of books featuring the young rabbits.

Wiesner, David. *Tuesday.* Illus. by the author. Clarion, 1991. Frogs fly through the air on mobile lily pads in a fantastic journey that ends at daybreak.

Yorinks, Arthur. *Hey Al.* Illus. by Richard Egielski. Farrar, 1986. A risky trip to a fantastic island makes a man and his dog appreciate their tiny home.

Beginning readers

Adler, David A. *Young Cam Jansen and the Baseball Mystery.* Illus. by Susanna Natti. Viking, 1999. Girl detective Cam Jansen solves the mystery in one of a series of upbeat books.

Bernier-Grand, Carmen T. *Juan Bobo: Four Folktales from Puerto Rico.* Illus. by Ernesto Ramos Nieves. HarperCollins, 1994. Exuberant folk-style illustrations adorn a collection of comic tales.



Illustration from *Mammalabilia,* copyright © by Douglas Florian, reproduced by permission of Harcourt Inc.

Mammalabilia is a collection of 21 playful rhymes and humorous illustrations about familiar and unusual animals that include the aardvark, the giraffe, and the coyote, *shown here.*

Cushman, Doug. *Inspector Hopper.* HarperCollins, 2000. A grasshopper and his sidekick beetle, McBugg, solve mysteries in their insect world.

DePaola, Tomie. *26 Fairmont Avenue.* Putnam, 1999. *Here We All Are.* Putnam, 2000. *On My Way.* Putnam, 2001. All books illus. by the author. A famous children's writer and illustrator offers three memoirs of his childhood.

Lobel, Arnold. *Frog and Toad Are Friends.* Illus. by the author. HarperCollins, 1970. Two good friends help and encourage each other in the first of four collections of stories.

Rylant, Cynthia. *Henry and Mudge and Annie's Perfect Pet.* Illus. by Suçie Stevenson. Simon & Schuster, 2000. One of a series describes the light-hearted adventures of a boy and his dog.

Seuss, Dr. *The Cat in the Hat.* Illus. by the author. Random Hse., 1957. A fantastic cat visits two children while their mother is out of the house.

Sharmat, Marjorie Weinman and **Mitchell.** *Nate the Great, San Francisco Detective.* Illus. by Martha Weston in the style of Marc Simont. Delacorte, 2000. Young Nate the Great helps his cousin solve a case while on a trip to California. This book is one of a long series about the popular junior detective.

Van Leeuwen, Jean. *Amanda Pig and Her Best Friend Lollipop.* Illus. by Ann Schweninger. Dial, 1998. This is one title in a reassuring series about Oliver and Amanda Pig.

Poetry

Adoff, Arnold. *The Basket Counts.* Illus. by Michael Weaver. Simon & Schuster, 2000. Free-verse poems capture the sounds, senses, and sights of the game of basketball. Intermediate readers.

Booth, David, comp. *Doctor Knickerbocker and Other Rhymes.* Illus. by Maryann Kovalski. Ticknor & Fields, 1993. Comic sketches accompany chants, poems, and jump-rope rhymes from playgrounds. Intermediate readers.

Brooks, Gwendolyn. *Bronzeville Boys and Girls.* Illus. by Ronni Solbert. Harper, 1956. Simple poems describe the experiences and feelings of African American children in big cities. Intermediate readers.

Fleischman, Paul. *Joyful Noise: Poems for Two Voices.* Illus. by Eric Beddows. Harper, 1988. Poems about insects are meant to be read aloud by two people. Intermediate readers.

Florian, Douglas. *Mammalabilia: Poems and Paintings.* Illus. by the author. Harcourt, 2000. The poet creates playful word pictures and fun paintings of 21 animals. Intermediate readers.

Hall, Donald, ed. *The Oxford Illustrated Book of American Children's Poems.* Oxford, 1999. The wide-ranging selections in-



Illustration by the author from *Jumanji* by Chris Van Allsburg. © 1981 by Chris Van Allsburg. Reprinted by permission of Houghton Mifflin Co.

Jumanji is a fantasy about a jungle adventure game that two children play at home one afternoon after their parents go out.

clude both fresh and familiar poems, many accompanied by period artwork. All ages.

Hopkins, Lee Bennett, comp. *Spectacular Science: A Book of Poems.* Illus. by Virginia Halstead. Simon & Schuster, 1999. This collection gathers verse about science by a variety of poets. Young readers. *My America: A Poetry Atlas of the United States.* Illus. by Stephen Alcorn. Simon & Schuster, 2000. Carl Sandburg, Langston Hughes, Nikki Giovanni, and many newly commissioned poets provide a journey across the United States enriched by powerful paintings and facts about the country's regions. Intermediate readers.

Hughes, Langston. *The Dream Keeper and Other Poems: Including Seven Additional Poems.* Illus. by Brian Pinkney. Knopf, 1994. Vivid illustrations add movement to these poems first published in 1932. Intermediate and older readers.

Kennedy, X. J. and **Dorothy M.,** comp. *Knock at a Star: A Child's Introduction to Poetry.* Rev. ed. Illus. by Karen Lee Baker. Little, Brown, 1999. This collection provides one of the best introductions to poetry. Intermediate readers.

Lear, Edward. *The Complete Nonsense Book.* Illus. by the author. Dodd, 1962. Limericks, nonsense poems, and humorous story poems sparkle in this book by a famous English comic poet and artist of the 1800's. Intermediate readers.

Livingston, Myra Cohn. *Cricket Never Does: A Collection of Haiku and Tanka.* Illus. by Kees de Kiefte. McElderry, 1997. Over 60 original haiku and tanka verses describe the four seasons. Intermediate and older readers.

Long, Sylvia, comp. *Sylvia Long's Mother Goose.* Chronicle, 1999. Over 80 verses are illustrated by the compiler with elegantly dressed animals, reptiles, and insects. Young readers.

McCord, David. *Speak Up: More Rhymes of the Never Was and Always Is.* Illus. by Marc Simont. Little, Brown, 1980. Witty, playful poems are written especially for young readers.

Merriam, Eve. *A Poem for a Pickle: Funnybone Verses.* Illus. by Sheila Hamanaka. Morrow, 1989. A high-spirited volume gathers examples of humorous poetry. Young readers.

Milne, A. A. *When We Were Very Young.* Dutton, 1952. *Now We Are Six.* Dutton, 1955. Both illus. by Ernest H. Shepard. Two classic collections of verse portray children and their world. Young readers.

Myers, Walter Dean. *Harlem.* Illus. by Christopher Myers. Scholastic, 1997. Poems and collages describe the people, sights, and sounds of New York City's Harlem. All ages.

National Museum of the American Indian, Smithsonian Institution. *When the Rain Sings: Poems by Young Native*





From *The Random House Book of Mother Goose,* selected and illustrated by Arnold Lobel. Illustrations © 1986 by Arnold Lobel. Reprinted by permission of Random House, Inc.

Nursery rhymes entertain children with simple, clever poems. Many of these poems appear in Mother Goose collections.



From *Back Home* by Gloria Jean Pinkney. Illustrated by Jerry Pinkney. Text © 1992 by Gloria Jean Pinkney. Illustrations © by Jerry Pinkney. Reprinted by permission of Dial Books for Young Readers, a division of Penguin Books USA, Inc.

Back Home describes the experiences of an African American girl from the city who visits relatives in rural North Carolina.



Illustration from *Hey, Al* by Arthur Yorinks, illustrated by Richard Egielski. Illustration © 1986 by Richard Egielski. Reproduced by permission of Farrar, Straus and Giroux, Inc.

Hey, Al is the story of a man named Al and his dog, Eddie, who live in a tiny apartment. One morning a giant purple bird invites them to visit a fantastic island paradise called Birdland.



Illustration from *Tuesday.* Text and illustrations © 1991 by David Wiesner. Reprinted by permission of Houghton Mifflin Co./Clarion Books. All rights reserved.

Tuesday is a story told almost entirely in pictures about frogs who leave their pond and float through the air to explore nearby houses one night.

Americans. Simon & Schuster, 1999. Poems by young Native Americans are inspired by, or matched with, photos of items from the museum's collection. Intermediate readers.

Nye, Naomi Shihab, comp. *This Same Sky: A Collection of Poems from Around the World.* Four Winds, 1992. Poetry from 68 countries celebrates everyday thoughts, actions, relationships, and the natural world. *The Space Between Our Footsteps: Poems and Paintings from the Middle East.* Simon & Schuster, 1998. Artists and writers from 20 countries create a collection of glorious paintings and poems from the Middle East. Both books for older readers.

Opie, Iona, ed. *My Very First Mother Goose.* Candlewick, 1996. *Here Comes Mother Goose.* Candlewick, 1999. Both books illus. by Rosemary Wells. Delightful water-color and ink pictures make these traditional nursery rhymes just right for young children. Young readers.

Pinkney, Gloria Jean. *Back Home.* Illus. by Jerry Pinkney. Dial, 1992. An African American child comes from the city to visit with Southern relatives.

Prelutsky, Jack, comp. *The 20th Century Children's Poetry Treasury.* Illus. by Meilo So. Knopf, 1999. A collection of over 200 poems by modern poets is grouped by related topics with fascinating illustrations. All ages.

Rylant, Cynthia. *Something Permanent.* Photos by Walker Evans. Harcourt, 1994. Stirring poems paired with a master photographer's historic images present a view of Southern life during the Great Depression. Older readers.

Silverstein, Shel. *Where the Sidewalk Ends: The Poems and Drawings of Shel Silverstein.* Harper, 1974. *A Light in the Attic.* Harper, 1981. *Falling Up: Poems and Drawings by Shel Silverstein.* HarperCollins, 1996. All illus. by the author. Skillful line drawings illustrate three collections of jolly verse. Intermediate readers.

Stevenson, James. *Cornflakes: Poems.* Illus. by the author. Greenwillow, 2000. A collection of charming poems and cartoonish sketches take on topics from guitars to garbage bags in one of a series. Intermediate readers.

Stevenson, Robert Louis. *A Child's Garden of Verses.* Illus. by Diane Goode. W. Morrow, 1998. An attractive interpretation presents a classic collection of short poems about the everyday world. Young readers.

Sutherland, Zena, comp. *The Orchard Book of Nursery Rhymes.* Illus. by Faith Jaques. Orchard Bks., 1990. English scenes of the 1700's illustrate the rhymes. Young readers.

Folk literature/fairy tales, folk tales, and myths

Aardema, Verna. *Why Mosquitoes Buzz in People's Ears.* Illus. by Leo and Diane Dillon. Dial, 1975. An amusing West African folk tale explains why mosquitoes make noise. Young readers.

Andersen, Hans Christian. *The Complete Fairy Tales and Stories.* Trans. from the Danish by Erik Christian Haugaard. Illus. Doubleday, 1974. A superb modern translation retells classic fairy tales. All ages.

Anno, Mitsumasa. *Anno's Twice Told Tales: The Fisherman and His Wife & The Four Clever Brothers by the Brothers Grimm & Mr. Fox.* Illus. by the author. Philomel, 1993. The author tells two sets of stories, one as seen by a fox, the other by the Brothers Grimm, the famous German collectors of fairy tales. Intermediate readers.

Asbjørnsen, Peter C., and **Moe, Jørgen.** *East of the Sun and West of the Moon and Other Tales.* Illus. by Tom Vroman. Macmillan, 1963. A famous collection gathers Norwegian fairy tales. Intermediate readers.

Brown, Marcia. *Stone Soup.* Illus. by the author. Aladdin, 1986. Originally published in 1947, this folk tale is about soldiers who trick villagers into making a soup fit for a king. Young readers.

Bruchac, Joseph. *Flying with the Eagle, Racing the Great Bear: Stories from Native North America.* Illus. by Murv Jacob. BridgeWater Bks., 1993. Sixteen Native American tales deal with the journeys of young men into manhood. Older readers.

Bruchac, Joseph, and **Ross, Gayle.** *The Girl Who Married the Moon: Tales from Native North America.* Illus. by S. S. Burrus. BridgeWater Bks., 1994. Sixteen Native American tales describe the passage into womanhood. Older readers.

Calvino, Italo, comp. *Italian Folktales.* Trans. by George Martin. Harcourt, 1980. Italian tales provide a rich resource for the storyteller as well as the reader. Intermediate readers.

Chase, Richard, ed. *The Jack Tales.* Houghton, 1943. *Grandfather Tales.* Houghton, 1948. Both illus. by Berkeley Williams, Jr. Two collections gather folk tales from rural North Carolina and Virginia. Both books for intermediate readers.

Cohn, Amy L., comp. *From Sea to Shining Sea: A Treasury of American Folklore and Folk Songs.* Illus. by 11 Caldecott Medal and 4 Caldecott Honor Book artists. Scholastic, 1993. A stunning compilation of material is as diverse and appealing as its illustrations. Intermediate readers.

D'Aulaire, Ingri, and **Parin, Edgar.** *Norse Gods and Giants.* Illus. by the authors. Doubleday, 1967. Stories describe the Norse gods and goddesses and retell Norse myths about how the world began and will end. Intermediate readers.

Dorson, Mercedes, and **Wilmot, Jeanne,** eds. *Tales from the Rain Forest: Myths and Legends from the Amazonian Indians of Brazil.* Ecco Press, 1997. A collection of 10 tales explains the origin of human beings and features of the natural world. Intermediate and older readers.

Goble, Paul, ad. *Iktomi and the Coyote: A Plains Indian Story.* Illus. by the adapter. Orchard Bks., 1998. This book is one in a series of casual and humorous tales about a Native American trickster. Young readers.

Grimm, Jakob and **Wilhelm.** *The Complete Fairy Tales.* Illus. by Josef Scharl. Pantheon, 1972. A reissue of a standard edition gathers well-known fairy tales. *The Juniper Tree and Other Tales from Grimm.* Lore Segal and Maurice Sendak, comp. Illus. by Maurice Sendak. Farrar, 1973. A translation from the German includes many less familiar tales. Young and intermediate readers.

Hamilton, Virginia, ad. *The People Could Fly: American Black Folktales.* Illus. by Leo and Diane Dillon. Knopf, 1985. Handsome pictures complement a major writer's retelling of traditional tales. *Her Stories: African American Folktales, Fairy Tales, and True Tales.* Illus. by Leo and Diane Dillon. Blue Sky Pr., 1995. The adapter retells 19 tales from African American folklore. Both books for intermediate and older readers.

Harris, Joel Chandler. *Jump! The Adventures of Brer Rabbit.* Illus. by Barry Moser. Ad. by Van Dyke Parks and Malcolm Jones. Harcourt, 1986. The first of several collections of Brer Rabbit stories compiled by this team is well told and illustrated with striking paintings. Intermediate readers.

Jacobs, Joseph, ed. *English Folk and Fairy Tales.* Putnam, 1900. *More English Folk and Fairy Tales.* Putnam, 1904. Both illus. by John D. Batten. A noted folklore scholar assembled these two famous collections of tales from England, Scotland, and Wales. Intermediate readers.

Jagendorf, M. A. *Noodlehead Stories from Around the World.* Illus. by Shane Miller. Vanguard, 1957. Comic folk tales from many lands deal with foolish people. Intermediate readers.

Kellogg, Steven, ad. *Paul Bunyan.* Morrow, 1984. *Pecos Bill.* Morrow, 1986. *Johnny Appleseed.* Morrow, 1988. *Mike Fink.* Morrow, 1992. All illus. by the author. Large-scale, animated illustrations accompany the author's retelling of these tales of larger-than-life American figures. Young readers.

Kimmel, Eric A., ad. *Anansi and the Talking Melon.* Illus. by Janet Stevens. Holiday Hse., 1994. A trickster spider eats his way into a large melon and convinces others that the fruit can speak. Young readers.

Lang, Andrew, ed. *The Blue Fairy Book.* Illus. by Ben Kutcher. McKay, 1948. A noted Scottish folklore scholar edited this collection, one of a series of anthologies of fairy tales from around the world. Intermediate readers.

Lester, Julius, ad. *The Last Tales of Uncle Remus: As Told by Julius Lester.* Illus. by Jerry Pinkney. Dial, 1994. Lester retells almost 40 of Joel Chandler Harris's stories about Brer Rabbit and his friends and enemies with the same vitality and sense of narrative that distinguished his three previous volumes of adaptations. Intermediate readers.

McCaughrean, Geraldine. *The Crystal Pool: Myths and Legends of the World.* Illus. by Bee Willey. McElderry, 1999. A collection of 28 stories includes tales from such cultures as the Inuit, Maori, Hindu, and Bantu. Older readers.

Napoli, Donna Jo. *Zel.* Dutton, 1996. A story based on Rapunzel explores the characters' motivations as chapters present the alternating points of view of Zel, her mother, and the prince. Older readers.

Normandin, Christine, ed. *Echoes of the Elders: The Stories and Paintings of Chief Lelooska.* Illus. by Chief Lelooska. DK Ink, 1997. *Spirit of the Cedar People: More Stories and Paintings of Chief Lelooska.* Illus. by Chief Lelooska. DK Ink, 1998. A master storyteller presents two important collections of traditional Northwest Coast Indian folk tales. CD's of Lelooska telling the tales are packaged with the books. Both books for intermediate and older readers.

Orgel, Doris. *Ariadne, Awake!* Illus. by Barry Moser. Viking, 1994. The Greek myth of Ariadne and Theseus and their encounter with the monstrous Minotaur is retold in compelling form. Intermediate readers.

Osborne, Mary Pope, ad. *Favorite Medieval Tales.* Illus. by Troy Howell. Scholastic, 1998. A collection presents nine well-known European tales, including "Beowulf" and "The Song of Roland." Intermediate and older readers.

Paterson, Katherine, ad. *The Tale of the Mandarin Ducks.* Illus. by Leo and Diane Dillon. Lodestar, 1990. A Japanese folk tale about kindness and compassion is gracefully retold and stunningly illustrated. Young readers.

Perrault, Charles. *Complete Fairy Tales.* Trans. from the French by A. E. Johnson and others. Illus. by W. Heath Robinson. Dodd, 1961. This volume offers original versions of 14 famous fairy tales, including "Cinderella" and "Little Red Riding Hood." Intermediate readers.

Philip, Neil, ad. *The Arabian Nights.* Illus. by Sheila Moxley. Orchard, 1994. Fifteen classic stories are retold with many jewel-toned, full-page illustrations. Intermediate and older readers.

San Souci, Robert D., comp. *Cut from the Same Cloth: American Women of Myth, Legend, and Tall Tale.* Illus. by Brian Pinkney. Philomel, 1993. A collection of 15 stories portrays legendary American women. Intermediate and older readers.

Singer, Isaac Bashevis. *When Shlemiel Went to Warsaw & Other Stories.* Trans. by the author and Elizabeth Shub. Illus. by Margot Zemach. Farrar, 1968. A master storyteller presents eight tales, some based on traditional Yiddish stories heard in his youth. Intermediate readers.

Snyder, Dianne. *The Boy of the Three-Year Nap.* Illus. by Allen Say. Houghton, 1988. In this Japanese trickster folk tale, a rich man is conned by a lazy boy, who is, in turn, outsmarted by his mother. Young readers.

Stevens, Janet, ad. *Tops and Bottoms.* Illus. by the adapter. Harcourt, 1995. Sly humor and creative illustrations enliven an African American folk tale about a hare and a bear. Young readers.

Trivizas, Eugene. *The Three Little Wolves and the Big Bad Pig.* Illus. by Helen Oxenbury. McElderry, 1993. An amusing tale will have special appeal to listeners and readers who recognize the role reversals. Young readers.

Uchida, Yoshiko, ad. *The Magic Purse.* Illus. by Keiko Narahashi. McElderry, 1993. In a retelling of a Japanese tale, a poor man receives unending wealth as payment for an act of kindness. Intermediate readers.

Yep, Laurence. *The Rainbow People.* Illus. by David Wiesner. Harper, 1989. A retelling of 20 Chinese folk tales is adapted from a 1930's oral narrative project in the Oakland (California) Chinatown. Intermediate and older readers.

Young, Ed, trans. *Lon Po Po: A Red Riding Hood Story from China.* Illus. by the translator. Philomel, 1989. An interesting Chinese variation retells a familiar folk tale with beautiful watercolor and pastel illustrations. *Seven Blind Mice.* Illus. by the adapter. Philomel, 1992. Stunning cut-paper figures illustrate this retelling of a tale from India in which blind mice encounter an elephant. Both books for young readers.

Zelinsky, Paul O., ad. *Rumpelstiltskin.* Illus. by the adapter. Dutton, 1986. *Rapunzel.* Illus. by the adapter. Dutton, 1997. Lush, realistic artwork enhances traditional retellings of these stories. Young and intermediate readers.

Folk literature/epics, ballads, and fables

Bertol, Roland. *Sundiata: The Epic of the Lion King.* Illus. by Gregorio Prestopino. Crowell, 1970. An epic describes the triumphs of Sundiata, founder of the African empire of Mali. Intermediate readers.

Craig, Helen, ad. *The Town Mouse and the Country Mouse.* Illus. by the adapter. Candlewick, 1992. An old tale appears in a cheerful, simplified version. Young readers.

De Gerez, Toni, ad. *Louhi, Witch of North Farm.* Illus. by Barbara Cooney. Viking, 1986. Warm paintings illustrate the story of a witch's attempt to steal the sun and the moon, adapted from the *Kalevala,* a Finnish epic. Young and intermediate readers.

Demi, ad. *A Chinese Zoo: Fables and Proverbs.* Illus. by the

adapter. Harcourt, 1987. A collection of smoothly told fables with morals is printed in both fine Chinese handwriting and English. Young readers.

Evslin, Bernard. *Hercules.* Illus. by Jos. Smith. Morrow, 1984. A lively story describes the adventures of the mythical Greek hero. Older readers.

Gross, Gwen, ad. *Knights of the Round Table.* Illus. by Norman Green. Random Hse., 1985. Simplified stories tell about King Arthur and his knights. Young readers.

Hazeltine, Alice, ed. *Hero Tales from Many Lands.* Illus. by Gordon Laite. Abingdon, 1961. Tales of real and legendary heroes come from such lands as England and Japan. Older readers.

Hodges, Margaret, and **Evernden, Margery.** *Of Swords and Sorcerers: The Adventures of King Arthur and His Knights.* Illus. by David Frampton. Scribner, 1993. Arthurian tales are retold with the richness of oral folklore and illustrated with woodcuts. Intermediate readers.

Kherdian, David, ad. *Feathers and Tails: Animal Fables from Around the World.* Illus. by Nonny Hogrogian. Philomel, 1992. Charming illustrations enliven a diverse collection of fables and folk tales. Young readers.

La Fontaine, Jean de. *Fables.* Trans. by Marianne Moore. Viking, 1954. All 241 fables by the French author appear in this acclaimed translation by a noted American poet. All ages.

Leodhas, Sorche Nic. *By Loch and by Lin: Tales from Scottish Ballads.* Illus. by Vera Bock. Henry Holt, 1969. Stories of adventure and romance have been adapted from traditional Scottish ballads. Intermediate readers.

Longfellow, Henry Wadsworth. *Paul Revere's Ride.* Illus. by Ted Rand. Dutton, 1990. Memorable verse re-creates the drama of the famous night ride. Intermediate readers.

McKinley, Robin. *The Outlaws of Sherwood.* Greenwillow, 1988. A fresh look at the Robin Hood stories gives new interpretations of the major characters. Older readers.

Pinkney, Jerry, ad. *Aesop's Fables.* Illus. by the adapter. SeaStar Bks., 2000. Expressive illustrations complement Aesop's wry observations of human nature. Intermediate readers.

Sutcliff, Rosemary, ad. *Black Ships Before Troy: The Story of the Iliad.* Illus. by Alan Lee. Delacorte, 1993. The memorable figures of the epic conflict between Greece and Troy are vividly portrayed. *The Wanderings of Odysseus: The Story of the Odyssey.* Illus. by Alan Lee. Delacorte, 1996. A fresh retelling describes the adventures Odysseus experienced on his voyage home from the Trojan War. Older readers.

Thayer, Ernest Lawrence. *Ernest L. Thayer's Casey at the Bat: A Ballad of the Republic Sung in the Year 1888.* Illus. by Christopher Bing. Handprint Bks., 2000. An imaginatively illustrated version retells the story of the famous strike-out in the form of newspaper clippings. Young and intermediate readers.

Fiction/general fiction for children*

Alcott, Louisa May. *Little Women.* Illus. by Jessie Wilcox Smith. Little, Brown, 1968. A classic novel describes four sisters growing up in New England during the American Civil War (1861-1865). Intermediate readers.

Bawden, Nina. *Humbug.* Clarion, 1992. An 8-year-old girl learns some powerful lessons when a crisis forces her to stay with the family of a nasty girl. Intermediate readers.

Blume, Judy. *Are You There God? It's Me, Margaret.* Bradbury, 1970. A realistic novel portrays an 11-year-old girl, her religious doubts, her social problems, and her reactions to her maturing body. Intermediate readers. *Here's to You, Rachel Robinson.* Orchard Bks., 1993. A gifted teen-aged girl deals with school, friends, an overachieving mother, and a rebellious brother. Older readers.

Burnford, Sheila. *The Incredible Journey.* Little, Brown, 1961. Two dogs and a cat struggle through the Canadian wilderness to reach their masters. Older readers.

Byars, Betsy. *Me Tarzan.* Illus. by Bill Cigliano. HarperCollins, 2000. When Dorothy lets loose her Tarzan yell, it has strange effects on the animals that hear it—even on the animals in a traveling circus. Intermediate readers.

Cameron, Ann. *The Stories Julian Tells.* Illus. by Ann Strugnell. Pantheon, 1981. Amusing stories describe a young boy's life with his family and new friend. One of a series. *Gloria's Way.* Illus. by Lois Toft. Farrar, 2000. Julian's spunky friend Gloria stars in her own humorous adventures. Young and intermediate readers.

Cleary, Beverly. *Ramona and Her Father.* Morrow, 1977. *Ramona Quimby, Age 8.* Morrow, 1981. Both books illus. by Alan Tiegreen. These two books form part of a warm and humorous series about a young girl. Young readers.

Collodi, Carlo. *The Adventures of Pinocchio.* Trans. from the Italian by Carol Della Chiesa. Illus. by Naiad Einsel. Macmillan, 1963. A wooden puppet has many adventures before he realizes his dream of becoming a real boy. Intermediate readers.

Coman, Carolyn. *What Jamie Saw.* Front Street, 1995. After his mother's boyfriend tries to throw his baby sister against a wall, 9-year-old Jamie and his mom struggle to protect their family in a new home. Intermediate and older readers.

Danziger, Paula. *Amber Brown Is Not a Crayon.* Illus. by Tony Ross. Putnam, 1994. This is the first in a series of realistic stories about a feisty 9-year-old girl. Young and intermediate readers.

DiCamillo, Kate. *Because of Winn-Dixie.* Candlewick, 2000. A lonely 10-year-old girl adopts an ugly, stray dog who helps

*Including all kinds of fiction except historical, mystery and detective, fantasy and science fiction, and realistic young adult fiction.



Text © 1975 by Verna Aardema, pictures © 1975 by Leo and Diane Dillon. Published by The Dial Press

A West African folk tale called *Why Mosquitoes Buzz in People's Ears* explains why mosquitoes make a buzzing sound. The artists used elements of traditional African art in their illustrations.



Illustration from *The Town Mouse and the Country Mouse.* Illustration © 1992 by Helen Craig. Permission granted by Walker Books Ltd., London. Published in U.S. by Candlewick Press.

The Town Mouse and the Country Mouse is a retelling of an Aesop fable about the lives of Tyler, a mouse who lives in the city, and Charlie, his cousin who lives in the countryside.

her find friendship and happiness. Intermediate readers.

Enright, Elizabeth. *Thimble Summer.* Illus. by the author. Henry Holt, 1966. A girl spends the summer on a Wisconsin farm. Intermediate readers.

Estes, Eleanor. *The Moffats.* Illus. by Louis Slobodkin. Harcourt, 1941. The everyday adventures of the Moffat children are affectionately told. Intermediate readers.

Farley, Walter. *The Black Stallion.* Random Hse., 1941. This is the first of more than 20 popular stories about the famous horse. Intermediate readers.

Farmer, Nancy. *A Girl Named Disaster.* Orchard Bks., 1996. While fleeing from Mozambique to Zimbabwe to escape an arranged marriage, a girl struggles to overcome starvation as she is tormented and guided by spirits in her world. Intermediate and older readers.

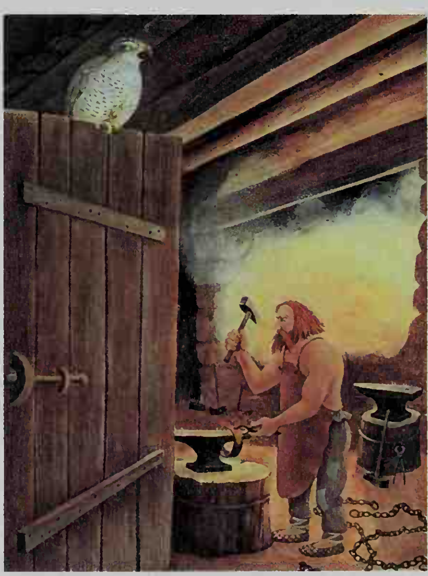


Illustration © 1986 by Barbara Cooney from *Louhi, Witch of North Farm* retold by Toni De Gerez. Reprinted by permission of Viking Penquin, Inc.

Louhi, Witch of North Farm is an adaptation of a story from the *Kalevala,* the national epic of Finland. The story describes a witch's attempt to steal the sun and the moon.

Fitzhugh, Louise. *Harriet the Spy.* Illus. by the author. Harper, 1964. An 11-year-old girl is shunned by her friends for her bitter comments. Intermediate readers.

Fleischman, Paul. *Seedfolk.* Illus. by Judy Pedersen. HarperCollins, 1997. Thirteen chapters narrated by different characters describe an urban garden started by a child and expanded and nurtured by people of varying ages and backgrounds. Older readers.

Fox, Paula. *Monkey Island.* Orchard Bks., 1991. Forced to live on the streets of New York City, an 11-year-old boy is befriended by two homeless men who help him survive. Intermediate and older readers.

Hamilton, Virginia. *M. C. Higgins, the Great.* Macmillan, 1974. A moving story describes an African American boy's protective love for his family. Older readers.

Hinton, S. E. *The Outsiders.* Viking, 1967. A classic young adult novel describes two teen-aged gangs in Oklahoma. Older readers.

Hunt, Irene. *Up a Road Slowly.* Follett, 1966. Julie painfully matures over a 10-year period while living with her unsympathetic aunt. Older readers.

Johnson, Angela. *Toning the Sweep.* Orchard Bks., 1993. Emily uses a video camera to record friends and impressions of her beloved, terminally ill grandmother and learns about a family history that spans three generations. Older readers.

Konigsburg, E. L. *Silent to the Bone.* Atheneum, 2000. A boy becomes mute when his baby sister goes into a coma and their unscrupulous nanny accuses him of having harmed her. Older readers.

Lawson, Robert. *Rabbit Hill.* Viking, 1944. *Tough Winter.* Viking, 1954. Both illus. by the author. Two stories tell about a family of rabbits living in the Connecticut countryside.

Lenski, Lois. *Strawberry Girl.* Illus. by the author. Lippincott, 1945. A realistic novel with regional flavor portrays strawberry farmers in Florida in the early 1900's. Intermediate readers.

Mathis, Sharon Bell. *The Hundred Penny Box.* Illus. by Leo and Diane Dillon. Viking, 1975. A touching story tells about a small African American child's love for a very old aunt. Intermediate readers.

Montgomery, Lucy Maud. *Anne of Green Gables.* Bantam, 1998. This is the first of a series of eight novels about the life of orphan Anne Shirley, from her arrival on a Prince Edward Island farm at age 11 to adulthood and motherhood. Originally published in 1908. Intermediate and older readers.

Myers, Walter Dean. *Somewhere in the Darkness.* Scholastic, 1992. A father leaves jail and insists that his adolescent son accompany him on a journey to prove his innocence and love. Older readers.

Namioka, Lensey. *Yang the Youngest and His Terrible Ear.* Joy Street Bks./Little, Brown, 1992. When Yingtao and his musically gifted family come to the United States from China, he discovers a flair for baseball that makes up for his failure with the violin. Intermediate readers.

Naylor, Phyllis Reynolds. *Shiloh.* Atheneum, 1991. *Shiloh Season.* Atheneum, 1996. *Saving Shiloh.* Atheneum, 1997. These three books make up a trilogy about a boy, his dog, and a man who once owned the animal. Intermediate readers.

Paterson, Katherine. *Bridge to Terabithia.* Illus. by Donna Diamond. Crowell, 1977. A touching story tells how a friendship is suddenly ended by a death. Intermediate and older readers. *Flip-Flop Girl.* Dutton, 1994. A young girl battling grief and anger over her father's death finds a role model for survival in an unlikely classmate. Intermediate readers.

Paulsen, Gary. *Hatchet.* Bradbury, 1987. After a plane crash, 13-year-old Brian spends 54 days in the Canadian wilderness before he is rescued. *Brian's Winter.* Delacorte, 1996. A sequel explores what would have happened if Brian had not been rescued before winter came. Both books for intermediate and older readers.

Rylant, Cynthia. *Missing May.* Orchard Bks., 1992. A 12-year-old girl finds hope and courage despite her grief after the death of the woman who has raised her. Intermediate readers.

Sachar, Louis. *Holes.* Farrar, 1998. A boy's bad luck lands him in

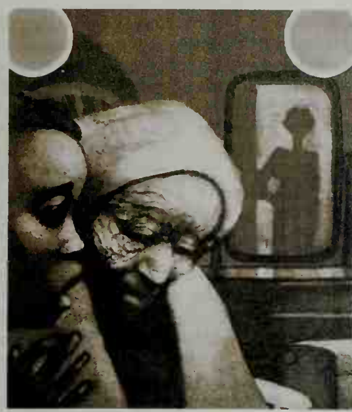


Illustration © 1975 by Leo and Diane Dillon from *The Hundred Penny Box* by Sharon Bell Mathis. Reprinted by permission of Viking Penguin Inc.

The Hundred Penny Box concerns an old woman who tells a boy about her life.

a correctional camp in the Texas desert. Intermediate and older readers.

Sneve, Virginia Driving Hawk. *High Elk's Treasure.* Illus. by Oren Lyons. Holiday Hse., 1972. A story about Joe High Elk and his family reveals Sioux Indian life and culture. Intermediate readers.

Spyri, Johanna. *Heidi.* Trans. from the German by Helen B. Dole. Illus. by William Sharp. Grosset, 1945. A Swiss girl's love and wholesomeness bring happiness to those around her. Intermediate readers.

Stevenson, Robert Louis. *Treasure Island.* Illus. by N. C. Wyeth. Scribner, 1939. In this classic adventure novel, young Jim Hawkins and his friends battle the villainous Long John Silver for possession of a buried treasure. Older readers.

Twain, Mark. *The Adventures of Tom Sawyer.* Illus. by Worth Brehm. Harper, 1938. *The Adventures of Huckleberry Finn.* Illus. by John Falter. Macmillan, 1962. Two classics of American fiction follow the adventures of two mischievous boys living near the Mississippi River in Missouri in the mid-1800's. Both books for older readers.

Fiction/historical fiction

Berry, James. *Ajeemah and His Son.* HarperCollins, 1992. An African father and son in the 1800's are taken captive by slave traders, transported to Jamaica, and sold separately. Older readers.

Bruchac, Joseph. *Crazy Horse's Vision.* Illus. by S. D. Nelson. Lee & Low, 2000. A fictionalized, illustrated biography focuses on the Lakota leader's journey to adulthood. Young and intermediate readers.

Collier, James Lincoln and **Christopher.** *With Every Drop of Blood.* Delacorte, 1994. During the American Civil War (1861-1865), a Confederate youth and a young African American Yankee soldier who has captured him slowly develop a friendship. Older readers

Curtis, Christopher Paul. *The Watsons Go to Birmingham--1963.* Delacorte, 1995. A middle-class African American family visits Grandma in Alabama in the summer of the church bombing. *Bud, Not Buddy.* Delacorte, 1999. Bud, a 10-year-old African American boy, searches for his father after his mother's death during the Great Depression. Both books for intermediate and older readers.

Cushman, Karen. *Catherine, Called Birdy.* Clarion, 1994. The 14-year-old daughter of an English country knight records her experiences in a journal. *The Midwife's Apprentice.* Clarion, 1995. In medieval England, a homeless girl finds her place in the world. Both books for intermediate and older readers.

Dorris, Michael. *Morning Girl.* Hyperion, 1992. Morning Girl and her brother tell a story of family life on an island in the Bahamas as white men land on their shores in 1492. Intermediate readers.

Fleischman, Paul. *Bull Run.* Illus. by David Frampton. HarperCollins, 1993. Sixteen voices present a variety of opinions and experiences in the American Civil War. Older readers.

Forbes, Esther. *Johnny Tremain.* Illus. by Lynd K. Ward. Houghton, 1943. A boy participates in events in Boston that lead to the outbreak of the Revolutionary War. Older readers.

Fox, Paula. *The Slave Dancer.* Illus. by Eros Keith. Bradbury, 1973. A boy witnesses the horrors of the slave trade while serving on a ship transporting slaves in 1840. Older readers.

Hamilton, Virginia. *The Bells of Christmas.* Illus. by Lambert Davis. Harcourt, 1989. An African American family in Ohio enjoys a Christmas reunion in 1890. Intermediate readers.

Hesse, Karen. *Out of the Dust.* Scholastic, 1997. Writing in sparse free verse, a teen-aged girl describes her life in the Oklahoma Dust Bowl during the Great Depression of the 1930's. Intermediate and older readers.

Lisle, Janet Taylor. *The Art of Keeping Cool.* Atheneum, 2000. A boy and his cousin find their own ways of dealing with a difficult family and a German painter who lives in their town during World War II (1939-1945). Intermediate and older readers.

Lowry, Lois. *Number the Stars.* Houghton, 1989. A historically accurate story of friendship shows how the people of Denmark saved Danish Jews from the Nazis. Intermediate readers.

MacLachlan, Patricia. *Sarah, Plain and Tall.* Harper, 1985. Two children learn to love the mail-order stepmother who comes to their lonely frontier home. Intermediate readers.

Namioka, Lensey. *The Coming of the Bear.* HarperCollins, 1992. Zenta and Matsuzo, medieval Japanese samurai, find themselves prisoners of the Ainu people. Intermediate readers.

O'Dell, Scott. *Island of the Blue Dolphins.* Houghton, 1960. An Indian girl is stranded for 18 years on a rocky island off the coast of California in the early 1800's. *Sarah Bishop.* Houghton, 1980. A tense story takes place during the Revolutionary War. Both books for older readers.

Paterson, Katherine. *Lyddie.* Lodestar, 1991. A teen-aged girl goes to work in the mills during the 1840's to help pay off the debts on her family's farm. Intermediate readers.

Speare, Elizabeth George. *The Witch of Blackbird Pond.* Houghton, 1958. A girl visiting Puritan Connecticut in the late 1600's becomes involved in witchcraft trials. Intermediate readers. *The Sign of the Beaver.* Houghton, 1983. A strong novel depicts an interracial friendship in the colonial period. Older readers.

Taylor, Mildred D. *Roll of Thunder, Hear My Cry.* Dial, 1976. An African American family endures the Great Depression. Intermediate readers.

Temple, Frances. *The Ramsay Scallop.* Orchard Bks., 1994. A fearless 14-year-old girl in the 1300's sets out on a religious pilgrimage to Spain with her betrothed. Older readers.

Uchida, Yoshiko. *Journey to Topaz: A Story of the Japanese-American Evacuation.* Scribner, 1971. A Japanese American girl and her family are sent to the War Relocation Center in Utah during World War II. *Journey Home.* McElderry, 1978. The family struggles to return to normal life after being released from the Relocation Center. Intermediate and older readers.

Westall, Robert. *The Machine Gunners.* Greenwillow, 1976. During World War II, English children build a fort to house a German machine gun they have found. Older readers.

Wilder, Laura Ingalls. *Little House in the Big Woods.* Illus. by Garth Williams. Harper, 1953. This is the first in a series of nine books about pioneer life in the late 1800's. Intermediate readers.

Yep, Laurence. *Dragon's Gate.* HarperCollins, 1993. A 14-year-old boy comes from China to the United States in 1867 to work on the railroad and becomes involved in a strike. Older readers.

Fiction/mystery and detective stories

Allen, Laura Jean. *Rollo and Tweedy and the Ghost at Dougal Castle.* Illus. by the author. HarperCollins, 1992. In a nicely plotted and paced story, two detective mice solve the mystery of a castle's resident ghost. Young readers.

Babbitt, Natalie. *Goody Hall.* Illus. by the author. Farrar, 1971. A mystery-adventure tale with some comic touches takes place in mysterious Goody Hall in England. Intermediate readers.

Bawden, Nina. *Devil by the Sea.* Lippincott, 1976. A girl cannot get anyone to believe that she knows the identity of a child murderer. Intermediate readers.

Bellairs, John. *The House with a Clock in Its Walls.* Dial, 1973. A search to find a clock programmed to end the world is the subject of the first mystery in a six-book series. Intermediate readers. *The Curse of the Blue Figurine.* Dial, 1983. This is the first of a series of nine atmospheric mysteries about Johnny Dixon and Professor Childermass.

Clifford, Eth. *Flatfoot Fox and the Case of the Nosy Otter.* Illus. by Brian Lies. Houghton, 1992. A brisk and humorous tale tells about a fox who is convinced he is the smartest detective in the world. Young readers.

Cross, Gillian. *Roscoe's Leap.* Holiday Hse., 1987. A boy senses dangerous secrets in a Gothic mansion that houses two separate branches of his family. Older readers.

Hamilton, Virginia. *The House of Dies Drear.* Macmillan, 1968. An African American boy helps uncover a treasure hidden near an old house by an abolitionist in the 1800's. *The Mystery of Drear House.* Greenwillow, 1987. The tale of hidden treasure reaches a conclusion. Both for intermediate readers.

Howe, James. *Dew Drop Dead: A Sebastian Barth Mystery.* Atheneum, 1990. When Sebastian and his friend explore an abandoned inn, they are shocked to discover a corpse. One of a series. Intermediate readers.

Pullman, Philip. *The Ruby in the Smoke.* Knopf, 1987. *Shadow in the North.* Knopf, 1988. *The Tiger in the Well.* Knopf, 1990. Suspenseful novels set in Victorian England tell the story of Sally Lockhart, orphaned at age 16, who with her friend Jim solves a series of adventurous mysteries. Older readers.

Raskin, Ellen. *The Westing Game.* Dutton, 1978. A wealthy man leaves intricate clues for his potential heirs. Intermediate readers.

Roberts, Willo Davis. *Twisted Summer.* Atheneum, 1996. Cici hopes for a fun summer at the beach but instead finds herself trying to solve a murder. *The Kidnappers: A Mystery.* Atheneum, 1998. With Joey's reputation for lying, no one believes him when he says he saw the class bully being kidnapped outside their New York City private school. Both books for intermediate readers.

Sobol, Donald J. *Encyclopedia Brown and the Case of the Slippery Salamander.* Illus. by Warren Chang. Delacorte, 1999. A boy detective solves a number of mysteries in one of a long series. Young and intermediate readers.

Wright, Betty Ren. *A Ghost in the Family.* Scholastic, 1998. Chad and his friend Jeannie encounter an eccentric aunt, a haunted boarding house, and a missing diamond bracelet in one of a series. Intermediate readers.

Fiction/fantasy and science fiction

Alexander, Lloyd. *The Book of Three.* Henry Holt, 1964. *The Black Cauldron.* Henry Holt, 1965. *The Castle of Llyr.* Henry Holt, 1966. *Taran Wanderer.* Henry Holt, 1967. *The High King.* Henry Holt, 1969. A series of five fantasies depict an imaginary kingdom in Wales. Intermediate readers.

Almond, David. *Skellig.* Delacorte, 1999. An English boy finds a mysterious stranger who is something like a bird and something like an angel, and he hopes the creature can help his ill sister. Older readers.

Barrie, J. M. *Peter Pan.* Ed. by Josette Frank from *Peter Pan and Wendy.* Illus. by Marjorie Torrey. Random Hse., 1957. A classic fantasy describes three children who fly to Never-Never Land with Peter Pan, a boy who refuses to grow up. Intermediate readers.

Barron, T. A. *The Lost Years of Merlin.* Philomel, 1996. The first in a series about the legendary wizard depicts his boyhood and youth. Older readers.

Baum, L. Frank. *The Wizard of Oz.* Illus. by W. W. Denslow. Reilly & Lee, 1956. In this famous fantasy, a cyclone carries Dorothy from a Kansas farm to a magical land. There she meets the Cowardly Lion, the Tin Woodman, the Scarecrow, and the Wizard of Oz. Intermediate readers.

Boston, Lucy M. *The Children of Green Knowe.* Harcourt, 1955. *The Treasure of Green Knowe.* Harcourt, 1958. Both illus. by Peter Boston. These are the first books in a series of fantasies about Green Knowe—an old English house—where children of today play with children of the past. All books for intermediate readers.

Carroll, Lewis. *Alice in Wonderland* and *Through the Looking-Glass.* Illus. by Sir John Tenniel. Grosset, 1963. Two classic fantasies tell about the adventures of Alice, who, in an imaginary land, meets such unforgettable characters as the Mad Hatter and the Queen of Hearts. Intermediate readers.

Christopher, John. *A Dusk of Demons.* Macmillan, 1994. A taut story of flight and danger is set in a future United Kingdom, in

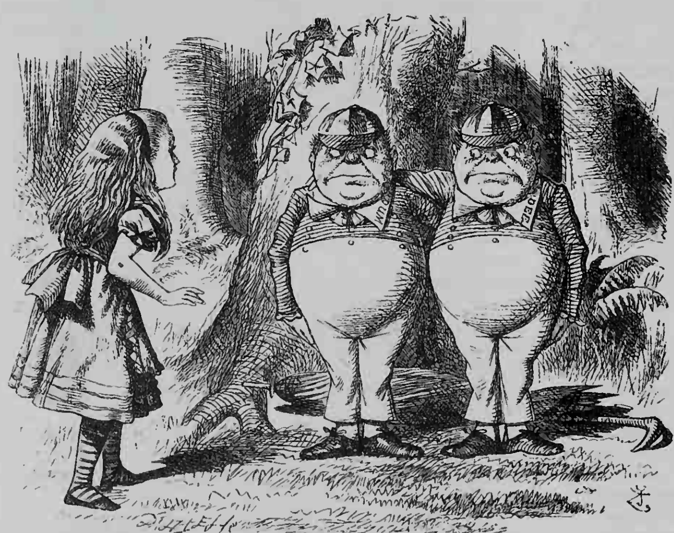


Illustration by Sir John Tenniel from the first edition (1872) of *Through the Looking-Glass and What Alice Found There* by Lewis Carroll; Macmillan and Company (Newberry Library, Chicago)

Through the Looking-Glass is a fantasy written by Lewis Carroll. It describes the adventures of a girl named Alice who was also the heroine of Carroll's *Alice in Wonderland.* In this picture, Alice meets Tweedledee and Tweedledum.



Illustration © 1989 by Lambert Davis. Reproduced from *The Bells of Christmas* by Virginia Hamilton by permission of Harcourt Brace Jovanovich.

The Bells of Christmas is a warm historical novel about the Christmas reunion of a black family living in rural Ohio in 1890.

which technology is avoided and superstition abounds. Intermediate readers.

Cooper, Susan. *Over Sea, Under Stone.* Illus. by Margery Gill. Harcourt, 1966. *The Grey King.* Illus. by Michael Heslop. Atheneum, 1975. Immortal beings battle evil forces that threaten the world in two of a series of five fantasies. *The Boggart.* McElderry, 1993. A brother and sister cope with the boggart, a feisty Scottish spirit who, trapped in a piece of furniture, has been shipped to their Canadian home. *The Boggart and the Monster.* McElderry, 1997. The children and the boggart attempt to help the boggart's cousin in Loch Ness. All books for intermediate readers.

Curry, Jane Louise. *Moon Window.* McElderry, 1996. A masterpiece of time-travel fiction tells the tale of JoEllen, a girl who bolts out of an elderly relative's attic window and finds herself back in time. Intermediate readers.

Danziger, Paula. *This Place Has No Atmosphere.* Delacorte, 1986. A comic novel set in the year 2057 tells about a girl who must adjust to moving to a new town—on the moon. Older readers.

Dickinson, Peter. *Eva.* Delacorte, 1989. The brain cells of a young girl are transferred into the body of a chimpanzee. Older readers.

Farmer, Nancy. *The Ear, the Eye, and the Arm.* Orchard Bks., 1994. A lively science-fiction story, set in Zimbabwe in 2194, has humor and mystery in a story of kidnapped children and bumbling chase sequences. Older readers.

Jacques, Brian. *Redwall.* Philomel, 1986. Animal characters encounter adventure, war, and beastly battles in the first in over a dozen novels of the Redwall saga. Intermediate and older readers.

Jones, Diana Wynne. *Hexwood.* Greenwillow, 1994. An intriguingly complex story, set on a farm outside of London, includes characters from King Arthur's time, robots, and powerful beings from other worlds. Older readers.

Le Guin, Ursula K. *A Wizard of Earthsea.* Parnassus, 1968. *The Tombs of Atuan.* Atheneum, 1971. *The Farthest Shore.* Atheneum, 1972. A series of stories describes the struggle between good and evil in the imaginary land of Earthsea. All books for older readers. *Catwings.* Orchard Bks., 1988. *Catwings Return.* Orchard Bks., 1989. *Wonderful Alexander and the Catwings.* Orchard Bks., 1994. *Jane on Her Own: A Catwings Tale.* Orchard Bks., 1999. All four books illus. by S. D. Schindler. Delicate illustrations enhance four stories about flying kittens. Young and intermediate readers.

L'Engle, Madeleine. *A Wrinkle in Time.* Farrar, 1962. In this first book in a trilogy, Meg and her brother and friend are taken to another part of the universe by three friendly witches and find Meg's father being held prisoner. Older readers.

Lewis, C. S. *The Chronicles of Narnia.* Illus. by Pauline Baynes. Macmillan, 1950-1956. Seven fantasies describe the adventures of four children in the magic land of Narnia. All for intermediate and older readers.

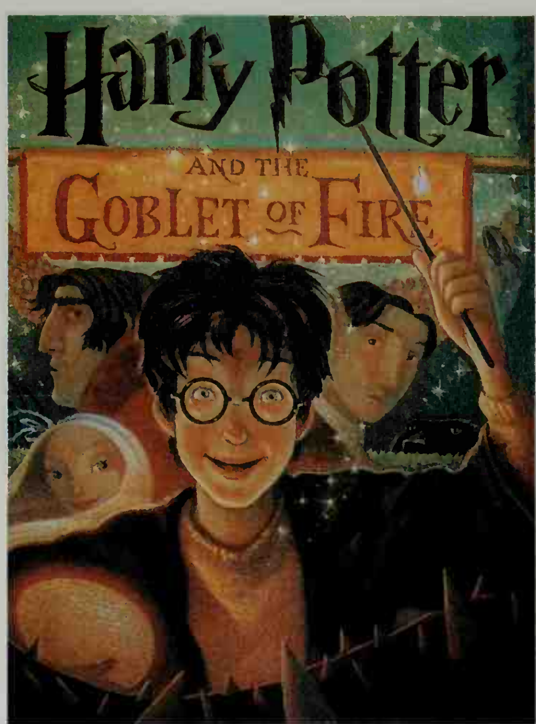
Lowry, Lois. *The Giver.* Houghton, 1993. A 12-year-old boy is chosen to be the keeper of a highly ordered society's past memories. With his trusted adviser, he seeks a way to bring emotion and freedom back to his people. Older readers.

Milne, A. A. *Winnie-the-Pooh.* Dutton, 1954. *The House at Pooh Corner.* Dutton, 1956. Both illus. by Ernest H. Shepard. Two amusing books portray Christopher Robin—the author's son—and the boy's adventures with his toy animals, who come to life. Both books for intermediate readers.

Pearce, Philippa. *Tom's Midnight Garden.* Illus. by Susan Einzig. Lippincott, 1958. A boy wandering through a relative's home finds a Victorian garden and a playmate from an earlier era. Intermediate and older readers.

Pullman, Philip. *The Golden Compass.* Knopf, 1996. *The Subtle Knife.* Knopf, 1997. *The Amber Spyglass.* Knopf, 2000. An epic English fantasy trilogy features intricate plots and exuberant storytelling. Older readers.

Rowling, J. K. *Harry Potter and the Sorcerer's Stone.* Arthur A. Levine, 1998. *Harry Potter and the Chamber of Secrets.* Arthur A. Levine, 1999. *Harry Potter and the Prisoner of Azkaban.* Arthur A. Levine, 1999. *Harry Potter and the Goblet of Fire.* Arthur A. Levine, 2000. These are the first four books in a best-



From *Harry Potter and the Goblet of Fire (Book 4)* by J. K. Rowling. Illustrations by Mary GrandPré. Published by Scholastic Press, a division of Scholastic Inc. Harry Potter, characters, names, and all related indicia are the trademarks of Warner Bros. © 2000.

Harry Potter and the Goblet of Fire is the fourth book in the series about a boy who discovers he has a wizard's powers.

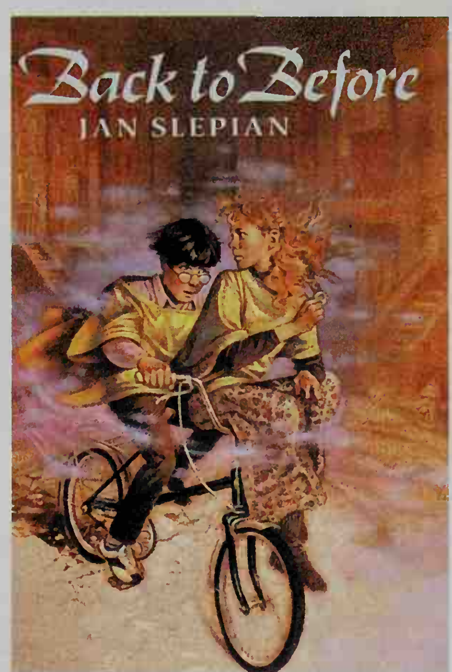


Illustration by Floyd Cooper reprinted by permission of Philomel Books from *Back to Before* by Jan Slepian, jacket art © 1993 by Floyd Cooper.

Back to Before is a science-fiction novel about two young cousins who discover that they have been moved back in time.



From *The Boy of the Three-Year Nap* by Dianne Snyder. Published by Houghton Mifflin Co. Illustrations copyright © 1988 by Allen Say. Reprinted with permission.

The Boy of the Three-Year Nap is a Japanese folk tale about a mother who finds a way to put her lazy son to work.

selling English fantasy series about a boy who discovers he has wizard powers.

Slepian, Jan. *Back to Before.* Philomel, 1993. Two cousins find themselves moved back in time and have a chance to change the events that have led to unhappy situations for each of them. Intermediate readers.

Tolkien, J. R. R. *The Hobbit.* Illus. by the author. Houghton, 1937. in this classic fantasy, a creature called a Hobbit seeks a treasure guarded by a mighty dragon. Intermediate and older readers.

Travers, P. L. *Mary Poppins.* Illus. by Mary Shepard. Harcourt, 1962. This is the first of several fantasies about an English nursemaid with magical powers and her adventures with the Banks children. Intermediate readers.

Voigt, Cynthia. *The Wings of a Falcon.* Scholastic, 1993. This long, well-sustained tale of villains and heroes in an imaginary land is the third in a series. Older readers.

White, E. B. *Stuart Little.* Illus. by Garth Williams. Harper, 1945. A fantasy describes a mouse born to human parents. *Charlotte's Web.* Illus. by Garth Williams. Harper, 1952. A friendship develops between a pig and a spider on a farm. *The Trumpet of the Swan.* Illus. by Edward Frascino. Harper, 1970. A Canadian swan born without a voice learns to communicate by playing the trumpet. All books for intermediate readers.

Fiction/realistic young adult fiction

Anderson, Laurie Halse. *Speak.* Farrar, 1999. A gripping novel about a high school freshman who is raped at a party by a popular senior boy at her school.

Bauer, Marion Dane, ed. *Am I Blue? Coming Out from the Silence.* HarperCollins, 1994. This collection gathers stories for young adults about coming to terms with homosexuality.

Brooks, Bruce. *The Moves Make the Man.* HarperTrophy, 1996. Two high school athletes, one an African American basketball player and the other a white baseball player, become friends, and the games become reflections of both of their lives.

Coman, Carolyn. *Many Stones.* Front Street, 2000. Berry and her father travel to South Africa to unveil a memorial to Berry's older sister, who was murdered near the school where she was volunteering.

Cormier, Robert. *The Chocolate War: A Novel.* Pantheon, 1974. In this classic, bitter story, one high school student chooses "to disturb the universe" by going against school tradition and pays a high price.

Crew, Linda. *Children of the River.* Delacorte, 1989. Having fled Cambodia, Sundara is torn between remaining faithful to her family and culture and enjoying her growing relationship with a boy from her Oregon high school.

Crutcher, Chris. *Staying Fat for Sarah Byrnes.* Greenwillow, 1993. Two high school seniors, fat Eric and disfigured Sarah, understand the meaning of friendship.

Fleischman, Paul. *Whirligig.* Henry Holt, 1998. Desperate to atone for killing a girl when driving drunk, Brent agrees to the victim's mother's request to travel to the corners of the United States to build whirligigs in her memory.

Fox, Paula. *The Moonlight Man.* Bradbury, 1986. A high school girl comes to terms with her alcoholic father.

Kerr, M. E. *Gentlehands.* Harper, 1978. Buddy falls in love with socially elite Skye and then discovers that his refined grandfather is a Nazi war criminal.

Mori, Kyoko. *Shizuko's Daughter.* Henry Holt, 1993. A Japanese girl fends for herself, and finds herself, after her mother's suicide. Older readers.

Myers, Walter Dean. *Fallen Angels.* Scholastic, 1988. A powerful story deals with the horror of the Vietnam War. *Monster.* Illus. by Christopher Myers. HarperCollins, 2000. A teen-aged boy records his experiences and emotions in the form of a movie script as he stands trial for murder.

Paterson, Katherine. *Jacob Have I Loved.* Crowell, 1980. On a Chesapeake Bay island during the 1940's, Louise searches for her identity and fights off the jealousy she feels toward her beautiful twin sister.

Rochman, Hazel, and **McCampbell, Darlene Z.** *Bearing Witness: Stories of the Holocaust.* Orchard, 1995. Twenty-four selections deal with the Nazi campaign against the Jews. *Who Do You Think You Are?: Stories of Friends and Enemies.* Little, Brown, 1994. Stories and excerpts describe friendship and enmity.

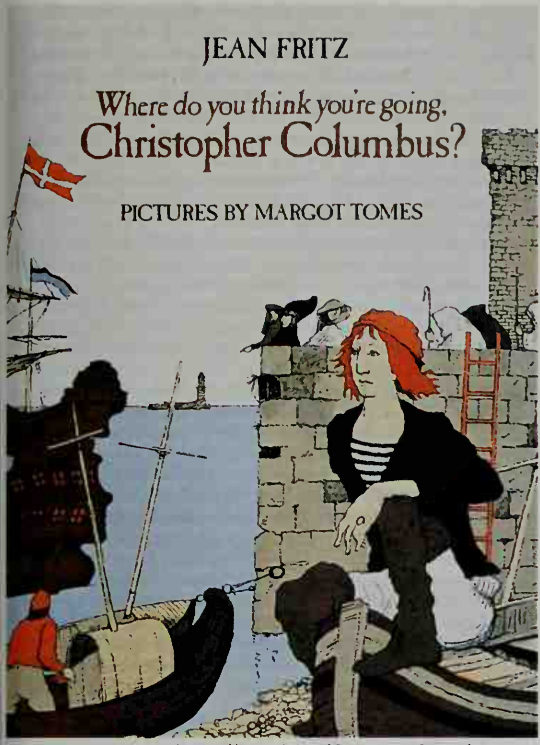
Staples, Suzanne Fisher. *Shabanu: Daughter of the Wind.* Knopf, 1989. The daughter of a nomad in the Cholistan Desert of Pakistan comes to understand her culture's views of the place of women and marriage.

Whelan, Gloria. *Homeless Bird.* HarperCollins, 2000. A 13-year-old girl is married, widowed, and later abandoned in a city of



Illustration by Trina Schart Hyman reprinted by permission of Coward, McCann & Geohegan from *Will You Sign Here, John Hancock?* by Jean Fritz. Illustrations © 1976 by Trina Schart Hyman

A biography of John Hancock tells the life story of one of the most famous signers of the Declaration of Independence.



Reprinted by permission of G. P. Putnam & Sons. *Where Do You Think You're Going, Christopher Columbus?* Text © 1980 by Jean Fritz. Illustration © 1980 by Margot Tomes

A biography of Christopher Columbus describes the voyages he commanded that led to the discovery of the New World.

widows in India, where she discovers a gift that helps her. Older readers.

Wittlinger, Ellen. *Hard Love.* Simon & Schuster, 1999. A boy falls for Marisol, a lesbian, who teaches him about friendship.

Biographies and autobiographies

Adler, David A. *A Picture Book of Jesse Owens.* Illus. by Robert Casilla. Holiday Hse., 1992. *A Picture Book of Rosa Parks.* Illus. by Robert Casilla. Holiday Hse., 1993. *A Picture Book of Sojourner Truth.* Illus. by Gershom Griffith. Holiday Hse., 1994. *A Picture Book of George Washington Carver.* Illus. by Dan Brown. Holiday Hse., 1999. Four books belong to a series of smoothly written biographies. All books for young readers.

Byars, Betsy. *The Moon and I.* Messner, 1991. A popular author's experiences and writing process emerge with engaging wit from the framework of a story about her encounters with a snake. Intermediate readers.

Cleary, Beverly. *A Girl from Yamhill: A Memoir.* Morrow, 1988. A favorite children's author examines her childhood in Oregon. *My Own Two Feet: A Memoir.* Morrow, 1995. Cleary continues her memoirs with her remembrances of college days, library work, early married life, and writing her first book. Both books for older readers.

Frank, Anne. *The Diary of a Young Girl.* Trans. from the Dutch by B. M. Mooyaart. Doubleday, 1967. A Jewish girl's autobiographical account tells of suffering and heroism during the Nazi occupation of the Netherlands in World War II. Older readers.

Freedman, Russell. *Lincoln: A Photobiography.* Clarion, 1987. The story of Abraham Lincoln and his times is told through text, photographs, and prints. *Eleanor Roosevelt: A Life of Discovery.* Clarion, 1993. A biography of the famous first lady provides a warm and dignified look at her life. Both books for intermediate and older readers.

Fritz, Jean. *Will You Sign Here, John Hancock?* Illus. by Trina Schart Hyman. Putnam, 1976. *Where Do You Think You're Going, Christopher Columbus?* Illus. by Margot Tomes. Putnam, 1980. *You Want Women to Vote, Lizzie Stanton?* Illus. by DyAnne DiSalvo-Ryan. Putnam, 1995. These are three of many well-researched books by a leading biographer for children. *Homesick: My Own Story.* Illus. by Margot Tomes. Putnam, 1982. *China Homecoming.* Putnam, 1985. The author tells her own life story in two autobiographical books. All books for intermediate readers.

Giblin, James Cross. *The Amazing Life of Benjamin Franklin.* Illus. by Michael Dooling. Scholastic, 2000. An illustrated biography provides interesting details about the great American inventor, thinker, and statesman. Intermediate readers.

Haskins, James, and **Benson, Kathleen.** *Space Challenger: The Story of Guion Bluford.* Carolrhoda, 1984. An exciting story tells about the first African American astronaut. Intermediate readers.

Jiang, Ji-li. *Red Scarf Girl: A Memoir of the Cultural Revolution.* HarperCollins, 1997. A memoir traces a Chinese girl's gradual disillusionment with what she had been taught to believe about her country's Communist government. Older readers.

Kuklin, Susan. *Iqbal Masih and the Crusaders Against Child Slavery.* Henry Holt, 1998. Iqbal, a young Pakistani rug weaver, broke out of bondage to become a leader against child slavery until he was murdered at age 12. Intermediate readers.

Lalicki, Tom. *Spellbinder: The Life of Harry Houdini.* Holiday Hse., 2000. Born in Hungary and raised in Wisconsin, Houdini became the master of escape. Intermediate readers.

Lewin, Ted. *I Was a Teenage Professional Wrestler.* Illus. by the author. Orchard Bks., 1993. This memoir provides an interesting glimpse of the wrestling world, in which Lewin worked to earn money for art school. Intermediate and older readers.

Lobel, Anita. *No Pretty Pictures: A Child of War.* Greenwillow, 1998. A children's book artist describes her experiences as a Polish Jewish child during World War II. Older readers.

Martin, Jacqueline Briggs. *Snowflake Bentley.* Illus. by Mary Azarian. Houghton Mifflin, 1998. A picture book biography of Wilson Bentley, a dairy farmer and photographer who discovered how to photograph snowflakes. Young readers.

Peet, Bill. *Bill Peet: An Autobiography.* Illus. by the author. Houghton, 1989. A popular creator of picture books tells the story of his life and work, including his years at the Walt Disney Studio. Intermediate readers.

Pinkney, Andrea Davis. *Alvin Ailey.* Illus. by Brian Pinkney. Hyperion, 1993. Handsome pictures reflect the grace and



Illustration by Barbara Cooney reprinted by permission of Philomel Books from *Only Opal: The Diary of a Young Girl* adapted by Jane Boulton, illustration © 1994 by Barbara Cooney.

Only Opal is the diary of a young orphaned girl who lives the life of a pioneer in Oregon at the turn of the century.

strength of a great African American dancer and choreographer (creator of dances). *Let It Shine: Stories of Black Women Freedom Fighters.* Illus. by Stephen Alcorn. Harcourt., 2000. Stories recount the challenges and triumphs of 10 courageous women in American history. Intermediate readers.

Ringgold, Faith. *My Dream of Martin Luther King.* Illus. by the author. Crown, 1995. A powerful picture book tells the story of the famous civil rights leader. Young readers.

Stanley, Diane. *Leonardo da Vinci.* Morrow, 1996. *Peter the Great.* Morrow, 1999. *Michelangelo.* HarperCollins, 2000. All illus. by the author. Stanley's series of picture book biographies examine complex lives using well-researched text and detailed illustrations. All books for intermediate readers.

Whiteley, Opal. *Only Opal: The Diary of a Young Girl.* Ad. by Jane Boulton. Illus. by Barbara Cooney. Philomel, 1994. A young orphaned pioneer who lived in Oregon about 1900 recorded her thoughts in a diary. Young readers.

Information books/science and technology

Aliki. *Digging Up Dinosaurs.* Illus. by the author. Harper, 1988. An introduction explains the excavation and study of fossilized dinosaur bones. Young readers.

Anno, Mitsumasa. *Anno's Math Games.* Philomel, 1987. *Anno's Math Games II.* Philomel, 1989. Both illus. by the author. Companion volumes introduce such mathematical concepts as relationships and measurement. Intermediate readers.

Arnold, Caroline. *El Niño: Stormy Weather for People and Wildlife.* Clarion, 1998. An informative book explores the nature and effects of the powerful tropical ocean current. Intermediate readers.

Brandenburg, Jim. *To the Top of the World: Adventures with Arctic Wolves.* Ed. by JoAnn Bren Guernsey. Photos by the author. Walker, 1993. Handsome color photographs and a clear text vividly present the habits and personalities of a pack of wolves. Intermediate readers.

Branley, Franklyn M. *The Planets in Our Solar System.* Illus. by Kevin O'Malley. HarperCollins, 1998. A clear description of the planets is accompanied by directions for making models and for other related activities. Young readers.

Cole, Joanna. *How You Were Born.* Rev. ed. Photos by Margaret Miller. Morrow, 1993. Clear descriptions of conception, fetal development, and birth are accompanied by diagrams and by photographs of families. Young readers.

Cowley, Joy. *Red-Eyed Tree Frog.* Photos by Nic Bishop. Scholastic, 1999. Simple text and vivid close-up photographs show a Central American rain forest frog as it searches for food and protects itself from other animals. Young readers.

Photograph by Nic Bishop from *Red-Eyed Tree Frog* by Joy Cowley. Published by Scholastic Press, a division of Scholastic Inc. Photographs copyright © 1999 Nic Bishop. Reprinted with permission.

Red-Eyed Tree Frog uses simple text and vivid close-up photographs to show a tree frog in a Central American rain forest as it searches for food and protects itself from other animals.

Fisher, Leonard Everett. *Galileo.* Illus. by the author. Macmillan, 1992. A clear explanation of Galileo's scientific contributions and of the principles on which they were based is accompanied by coverage of his life. Intermediate readers.

Harris, Robie H. *It's Perfectly Normal: A Book about Changing Bodies, Growing Up, Sex, and Sexual Health.* Illus. by Michael Emberley. Candlewick, 1994. Humorous cartoons and candid text describe the changes that occur during puberty, as well as their implications. Older readers.

Keller, Laurie. *Open Wide: Tooth School Inside.* Illus. by the author. Henry Holt, 2000. Zany Dr. Flossman instructs his class of 32 teeth about dental care. Intermediate readers.

Leedy, Loreen. *Fraction Action.* Holiday Hse., 1994. *Subtraction Action.* Both books illus. by the author. Holiday Hse., 2000. Clear and amusing explanations clarify mathematical concepts. Young readers.

Macaulay, David, and **Ardley, Neil.** *The New Way Things Work.* Illus. by David Macaulay. Houghton, 1998. A clear and often humorous explanation tells how hundreds of machines work. Intermediate and older readers.

Pringle, Laurence. *An Extraordinary Life: The Story of a Monarch Butterfly.* Illus. by Bob Marstall. Orchard Bks., 1997. An absorbing and informative story of the life of one monarch butterfly is illustrated with colorful paintings. *Bats! Strange and Wonderful.* Illus. by Meryl Henderson. Boyds Mills, 2000. A highly respected science writer introduces many different kinds of bats and discusses how they contribute to our environment. Both books for intermediate readers.

Provensen, Alice and **Martin.** *The Glorious Flight: Across the Channel with Louis Blériot.* Illus. by the authors. Viking, 1983. An exciting story describes a landmark event in flight history. Young and intermediate readers.

Schwartz, David M. *How Much Is a Million?* Illus. by Steven Kellogg. Lothrop, 1985. *On Beyond a Million: An Amazing Math Journey.* Illus. by Paul Meisel. Doubleday, 1999. Excellent books help children understand the concept of large numbers. Young readers.

Showers, Paul. *A Drop of Blood.* Rev. ed. Illus. by Don Madden. Crowell, 1989. A simple explanation of what blood is, how it works in the body, how bleeding stops, and why the body never runs out of blood. Young readers.

Simon, Seymour. *Gorillas.* HarperCollins, 2000. A concise narrative and color photographs explore how gorillas live, communicate, and play. Intermediate readers.

Snedden, Robert. *What Is a Bird?* Illus. by Adrian Làscom. Photos by Oxford Scientific Films. Sierra Club, 1993. Clearly presented facts and pictures provide details of bird anatomy and flight patterns. Young and intermediate readers.

Wick, Walter. *A Drop of Water: A Book of Science and Wonder.* Photos by the author. Scholastic, 1997. Precise, simple text and clear, close-up photographs demonstrate the nature of water. The book includes suggestions for easily conducted experiments. Young and intermediate readers.

Wolf, Bernard. *HIV Positive.* Dutton, 1997. A photo essay shows how a 29-year-old mother bravely faces AIDS on a daily basis. Intermediate readers.

Information books/geography

Armstrong, Jennifer. *Shipwreck at the Bottom of the World: The Extraordinary True Story of Shackleton and the Endurance.* Crown, 1998. In a 1914 expedition, Ernest Henry Shackleton and his men were trapped in a frozen Antarctic sea for nine months, then made a perilous journey to reach inhabited land. Accompanied by photographs of the expedition. Older readers.

Brandenburg, Jim. *Sand and Fog: Adventures in South Africa.* Ed. by JoAnn Bren Guernsey. Photos by the author. Walker, 1994. Stunning photographs add to the lure of a text about the unusual deserts, climate, and wildlife of Namibia. Intermediate readers.

Fritz, Jean. *Around the World in a Hundred Years: From Henry the Navigator to Magellan.* Illus. by Anthony Bacon Venti. Putnam, 1994. A historical account follows the voyages of 10 explorers whose findings contributed to knowledge about

Africa, India, and the Americas. Intermediate readers.

Johnson, Sylvia A. *Mapping the World.* Atheneum, 1999. A chronological history examines how mapmaking has developed over the centuries. Intermediate readers.

Lauber, Patricia. *Volcano: The Eruption and Healing of Mount St. Helens.* Bradbury, 1986. An informative book chronicles the 1980 eruption and examines the area's ecological recovery. Intermediate readers.

Lourie, Peter. *Everglades: Buffalo Tiger and the River of Grass.* Boyds Mills, 1994. *Erie Canal: Canoeing America's Great Waterway.* Boyds Mills, 1997. *Rio Grande: From the Rocky Mountains to the Gulf of Mexico.* Boyds Mills, 1999. All illus. with photos by the author. Lourie brings readers along on his waterway journeys, relating historical and current information through interesting text, photos, and archival materials. All books for young and intermediate readers.

National Geographic World Atlas for Young Explorers. National Geographic Soc., 1998. *National Geographic United States Atlas for Young Explorers.* National Geographic Soc., 1999. Excellent resources combine geographic, political, and environmental details on easy-to-read maps. Both books for intermediate readers.

Simon, Seymour. *Mountains.* Morrow, 1994. Handsome, full-page photographs illustrate a brisk, clear description of different kinds of mountains. Intermediate readers.

Information books/history

Aliki. *William Shakespeare & the Globe.* Illus. by the author. HarperCollins, 1999. Aliki provides a fine introduction to Shakespeare, the Globe, and the world in which the playwright and theater thrived. Intermediate readers.

Bartoletti, Susan Campbell. *Growing Up in Coal Country.* Houghton, 1996. A photo essay depicts children at work in the coal mines of northeastern Pennsylvania about 100 years ago. Intermediate and older readers.

Blumberg, Rhoda. *Full Steam Ahead: The Race to Build a Transcontinental Railroad.* National Geographic Soc., 1996. An account of the building of the railroad features numerous period illustrations of the mammoth undertaking. Older readers.

De Pauw, Linda. *Founding Mothers: Women of America in the Revolutionary Era.* Illus. by Michael McCurdy. Houghton, 1975. A history of the U.S. colonial period examines the roles played by women. Older readers.

Freedman, Russell. *An Indian Winter.* Illus. by Karl Bodmer. Holiday Hse., 1992. A dramatic account describes a winter spent with the Mandan Indians in what is now North Dakota by a German prince and a Swiss painter in the 1830's. Older readers. *Kids at Work: Lewis Hine and the Crusade Against Child Labor.* Photos by Lewis Hine. Clarion Bks., 1994. The story of photographer Hine's battle against child labor during the early 1900's is well told and documented through his work. Intermediate and older readers.

Fritz, Jean. *China's Long March: 6,000 Miles of Danger.* Illus. by Yang Zhr Cheng. Putnam, 1988. The story of the Communist Army's journey across China in 1934 and 1935 is based on interviews with survivors. Older readers.

Hamilton, Virginia. *Many Thousand Gone: African Americans from Slavery to Freedom.* Knopf, 1993. Illus. by Leo and Diane Dillon. A remarkable blend of documented history and brief remembrances portrays a continuing story of courage. Intermediate readers.

Lawrence, Jacob. *The Great Migration: An American Story.* Illus. by the author. HarperCollins, 1993. Sixty paintings created in 1940 and 1941 by this renowned artist illustrate his story of the northward migration of African Americans in search of a better life. Intermediate readers.

Murphy, Jim. *The Great Fire.* Scholastic, 1995. Separating fact from fiction about the Chicago tragedy, the author sets the record straight through documents, accounts, photographs, and illustrations. Intermediate and older readers.

Sattler, Helen Roney. *The Earliest Americans.* Illus. by Jean Day Zallinger. Clarion, 1993. A heavily illustrated and well-indexed scientific account surveys the theories about the first inhabitants of the Americas. Intermediate readers.

Sneve, Virginia Driving Hawk. *The Navajos: A First Americans Book.* Holiday Hse., 1993. *The Sioux: A First Americans Book.* Holiday Hse., 1993. *The Apaches: A First Americans Book.* Holiday Hse., 1997. All books illus. by Ronald Himler. Three books belong to a series of excellent, handsomely illustrated overviews of Native American history and heritage. All books for intermediate readers.

Information books/government and politics

Bartoletti, Susan Campbell. *Kids on Strike!* Houghton, 1999. A historical treatment explains the role children played in working toward labor reform and developing child labor laws. Intermediate readers.

Crampton, William. *Flag.* Illus. by Martin Plomer. D K Pub., 2000. Part of the Eyewitness Books series, an impressive, colorful book describes the history and use of flags and gives examples from many nations. Young and intermediate readers.

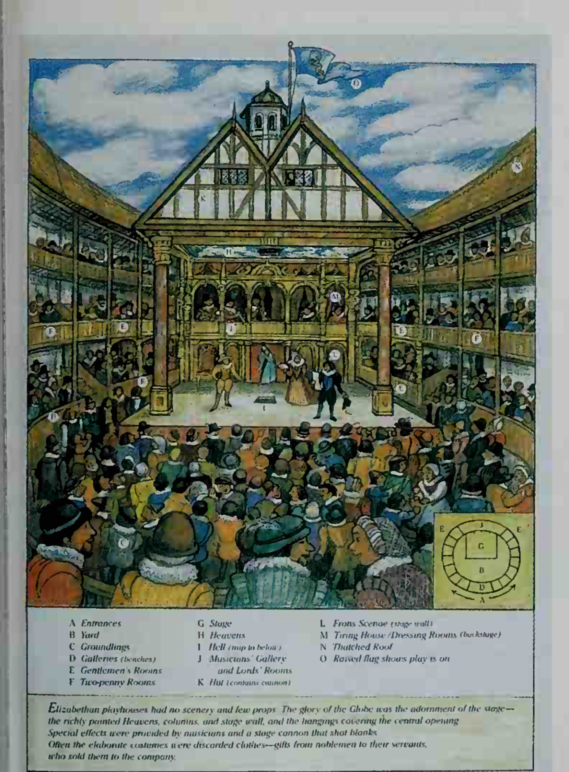
Freedman, Russell. *Give Me Liberty: The Story of the Declaration of Independence.* Holiday Hse., 2000. A dependable historian who is also an exciting writer provides a fresh look at the events leading up to, and the creation of, the political document. Intermediate and older readers.

Fritz, Jean. *Shh! We're Writing the Constitution.* Illus. by Tomie dePaola. Putnam, 1987. A lively, detailed description portrays the conflict among delegates to the Constitutional Convention. Intermediate readers.

Gaustad, Edwin S. *Church and State in America.* Oxford Univ. Pr., 1999. An overview examines the conflicts between religion and government. Older readers.

Gottfried, Ted. *Capital Punishment: The Death Penalty Debate.* Enslow, 1997. The author presents strong arguments for each side. Older readers.

Krull, Kathleen. *A Kids' Guide to America's Bill of Rights: Curfews, Censorship, and the 100-Pound Giant.* Illus. by Anna Di-



From *William Shakespeare & the Globe* by Aliki. Copyright © 1999 text and illustrations by Aliki. Published by HarperCollins, Inc. Reprinted with permission.

William Shakespeare & the Globe provides an introduction to playwright William Shakespeare, the Globe Theatre, and the world in which the playwright and theater thrived.

Vito. Avon, 1999. In clear, approachable text, Krull describes each of the first 10 amendments in depth and touches upon later amendments and constitutional controversies. Intermediate readers.

Levine, Ellen. *Freedom's Children: Young Civil Rights Activists Tell Their Own Stories.* Illus. with photographs. Putnam, 1993. African American Southerners who were involved in the civil rights struggles of the 1950's and 1960's describe their feelings and experiences. Intermediate and older readers.

Lewis, Barbara A. *The Kid's Guide to Social Action: How to Solve the Social Problems You Choose—and Turn Creative Thinking into Positive Action.* Rev. ed. Ed. By Pamela Espeland and Caryn Pernu. Free Spirit, 1998. A clear overview explains how to become a political activist, including true stories of children's political actions, sample forms of petitions and surveys, and information about how to contact government and social action groups. Intermediate and older readers.

Miller, Marilyn. *Words That Built a Nation.* Scholastic, 1999. An effective chronological presentation of more than three dozen historic documents, including famous speeches, letters, books, lyrics, and dialogue, is accompanied by facsimiles and archival photos. Intermediate and older readers.

Price-Groff, Claire. *Twentieth-Century Women Political Leaders.* Facts on File, 1998. Profiles describe 12 women political leaders from around the world. Older readers.

St. George, Judith. *So You Want to Be President?* Illus. by David Small. Philomel, 2000. Entertaining trivia and thought-provoking lessons add to an overview of the American presidents. Intermediate readers.

Weber, Michael. *Our Congress.* Millbrook, 1996. A clear introduction explains the electoral process and the legislative branch of government. Young and intermediate readers.



From *To Every Thing There Is a Season* by Leo & Diane Dillon. Published by Blue Sky Press, an imprint of Scholastic Inc. Illustrations copyright © by Leo & Diane Dillon. Reprinted with permission.

To Every Thing There Is a Season explores themes from many cultures through the text of Ecclesiastes from the King James Version of the Bible and a striking variety of illustrations.

Information books/religion

Ammon, Richard. *An Amish Christmas.* Atheneum, 1996. *An Amish Wedding.* Atheneum, 1998. *An Amish Year.* Atheneum, 2000. All books illus. by Pamela Patrick. Three picture books with realistic illustrations describe Amish life. All books for young readers.

Armstrong, Carole. *Women of the Bible: With Paintings from the Great Art Museums of the World.* Simon & Schuster, 1998. Large reproductions of mostly Renaissance paintings illustrate stories of biblical women, including Eve, Sarah, Bathsheba, Ruth, and Mary. Intermediate and older readers.

Bial, Raymond. *Shaker Home.* Photos by the author. Houghton, 1994. A beautiful, full-color photo essay introduces the traditional Shaker way of life. Intermediate readers.

Bible. To Every Thing There Is a Season: Verses from Ecclesiastes. Illus. by Leo and Diane Dillon. Blue Sky Pr., 1998. This selection from the King James Version of the Bible is conveyed through a stunning array of illustrations that embrace motifs from many cultures. All ages.

Chödzin, Sherab, and **Kohn, Alexandra,** ads. *The Wisdom of the Crows and other Buddhist Tales.* Illus. by Marie Cameron. Tricycle Pr., 1997. A collection of Buddhist tales from several Asian cultures illustrates various aspects of Buddhist thought. Intermediate and older readers.

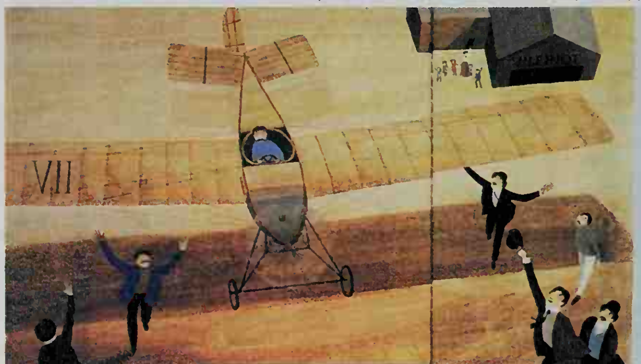
Gellman, Marc, and **Hartman, Thomas.** *How Do You Spell God? Answers to the Big Questions from Around the World.* Illus. by Jos. A. Smith. Morrow, 1995. In a clear style, the authors respectfully describe such religions as Judaism, Christianity, Islam, Buddhism, and Hinduism, discussing similarities and differences, questions of faith, and the role of religion in people's lives. Intermediate and older readers.

Kimmel, Eric A., ad. *Be Not Far from Me: The Oldest Love Story: Legends from the Bible.* Illus. by David Diaz. Simon & Schuster, 1998. This collection combines 20 stories from the Bible and the Midrash, Jewish commentaries on scripture, with dynamic illustrations. Intermediate and older readers.

Kuskin, Karla. *A Great Miracle Happened There: A Chanukah Story.* Illus. by Robert Andrew Parker. Willa Perlman Bks, 1993. Line and water-color drawings illustrate a direct, dignified account of the events commemorated by the Jewish holiday. Young readers.

Marchant, Kerena. *Id-ul-Fitr.* Millbrook, 1998. A clear discussion of the Muslim festival that marks the end of Ramadan includes information about how Id-ul-Fitr is celebrated in different parts of the world. Young and intermediate readers.

Illustration © 1983 by the authors Alice and Martin Provensen. Reprinted by permission of Viking Penguin Inc.



The first airplane flight across the English Channel in 1909 is described in *The Glorious Flight: Across the Channel with Louis Blériot.* Blériot was a French aviation pioneer.

McKissack, Patricia and **Fredrick**. *Let My People Go: Bible Stories Told by a Freeman of Color to his Daughter, Charlotte, in Charleston, South Carolina, 1806-16.* Illus. by James E. Ransome. Atheneum, 1998. Stories from the Bible are told and related to the experiences of African Americans through the voices of a fictionalized father and daughter living in the 1800's. Intermediate readers.

Strickland, Tessa, comp. *One Earth, One Spirit: A Child's Book of Prayers from Many Faiths and Cultures.* Sierra Club, 1997. Prayers celebrating the relationship between people and the natural world are matched with fitting photographs. Intermediate readers.

Information books/racial and ethnic groups

Ancona, George. *Barrio: José's Neighborhood.* Photos by the author. Harcourt, 1998. A photo essay presents life in a Hispanic neighborhood in San Francisco. Younger and intermediate readers.

Ashabranner, Brent. *To Seek a Better World: The Haitian Minority in America.* Photos by Paul Conklin. Cobblehill, 1997. An overview of Haitian history sets the context for profiles of long-term and recent immigrants. Intermediate and older readers.

Begay, Shonto. *Navajo: Visions and Voices Across the Mesa.* Illus. by the author. Scholastic, 1995. Twenty paintings, combined with poems that include traditional prayers and stories, provide a view of Navajo life. Intermediate and older readers.

Bierman, Carol, and **Hehner, Barbara.** *Journey to Ellis Island: How My Father Came to America.* Illus. by Laurie McGaw. Hyperion, 1998. The true story of one family's efforts to reach and gain entry into the United States is illustrated with stirring paintings, period postcards, and photographs. Intermediate readers.

Birdseye, Debbie Holsclaw and **Tom.** *Under Our Skin: Kids Talk About Race.* Photos by Robert Crum. Holiday Hse, 1997. Six young people discuss their ethnic backgrounds and experiences. Intermediate readers.

Bode, Janet. *The Colors of Freedom: Immigrant Stories.* Watts, 1999. Teen-aged immigrants share their experiences, thoughts, and native recipes. Older readers.

Cha, Dia. *Dia's Story Cloth: The Hmong People's Journey to Freedom.* Illus. stitched by Chue and Nhia Thao Cha. Lee & Low with the Denver Museum of Natural History, 1996. A story cloth stitched by the author's aunt and uncle tells the family's history, including settlement in Laos, war, escape, and arrival in the United States. Intermediate and older readers.



From *Visiting the Art Museum* by Laurene Krasny Brown and Marc Brown. © 1986 by Laurene Krasny Brown and Marc Brown. Reprinted by permission of the publisher, Dutton Children's Books, a division of Penguin Books USA Inc.

Visiting the Art Museum describes a family's visit to a museum. The book includes reproductions of masterpieces painted by Pierre Auguste Renoir, *shown here,* and other well-known artists in its discussion of art objects.

Clinton, Catherine. *The Black Soldier: 1492 to the Present.* Houghton, 2000. The author tells the story of black soldiers throughout American history, from those who accompanied Christopher Columbus to those who fought in the Persian Gulf War. Intermediate and older readers.

Holbrook, Sabra. *Canada's Kids.* Atheneum, 1983. A survey describes Canada's ethnic groups and their integration into Canadian life. Older readers.

Littlechild, George. *This Land Is My Land.* Illus. by the author. Children's Book Pr., 1993. A member of the Plains Cree Nation recounts his own experiences and his ancestral history. Intermediate readers.

Meltzer, Milton. *Never to Forget: The Jews of the Holocaust.* Harper, 1976. A vivid documentary study recounts Jewish suffering under the Nazis. *Rescue: The Story of How Gentiles Saved Jews in the Holocaust.* Harper, 1988. True stories tell how individual acts of heroism saved Jews from almost certain death. Both books for older readers.

Patrick, Diane. *The New York Public Library Amazing African American History.* Wiley, 1998. An accessible question-and-

Dia's Story Cloth text and illustrations © copyright 1996 by the Denver Museum of Natural History. Permission arranged with Lee & Low Books, Inc.



Dia's Story Cloth describes a Hmong family's journey from Laos to the United States. The story cloth was stitched by the author's aunt and uncle. It tells the family's history, including their escape from that war-torn Asian country.

answer format provides information about African American history. Intermediate and older readers.

Walter, Mildred Pitts. *Kwanzaa: A Family Affair.* Lothrop, 1995. A guide explains how to prepare for and celebrate the African American festival of Kwanzaa. Intermediate readers.

Yep, Laurence, ed. *American Dragons: Twenty-Five Asian American Voices.* HarperCollins, 1993. A collection of eloquent stories, poems, and play excerpts about growing up in the United States is accompanied by background notes about the authors. Older readers.

Information books/the arts

Arnold, Caroline. *Stories in Stone: Rock Art Pictures by Early Americans.* Photos by Richard Hewett. Clarion, 1996. An overview of the rock art of the Coso Range of California explains what it can reveal about the people who created it hundreds and thousands of years ago. Intermediate readers.

Brown, Laurene Krasny and **Marc.** *Visiting the Art Museum.* Illus. by the authors. Dutton, 1986. A family visit to the museum provides the basis for a lively discussion about art. Includes small-scale reproductions of famous works of art. Young readers.

Collier, James Lincoln. *Jazz: An American Saga.* Holt, 1997. A survey of jazz examines the possible origins of the music, the development of jazz solos, and the importance of individual styles and artists. Older readers.

Greenberg, Jan, and **Jordan, Sandra.** *The Painter's Eye: Learning to Look at Contemporary American Art.* Delacorte, 1991. More than 20 artists' works are discussed in an excellent survey that includes technical details, art mediums and styles, and comments by artists. *The Sculptor's Eye: Looking at Contemporary American Art.* Delacorte, 1993. A companion volume devoted to modern work is enlivened by interviews with sculptors. Both books for intermediate and older readers.

Hughes, Langston. *The First Book of Jazz.* Photographs by Cliff Roberts. Watts, 1955. An introduction to jazz analyzes what jazz is and traces the history of the music from its origins to the mid-1900's. Older readers.

Johnson, James Weldon. *Lift Every Voice and Sing.* Illus. by Elizabeth Catlett. Walker, 1993. A classic song of African American history is combined with strong linocut pictures. Intermediate and older readers.

Krull, Kathleen, comp. *Gonna Sing My Head Off!: American Folk Songs for Children.* Illus. by Allen Garns. Knopf, 1992. Useful background notes and simple piano and guitar arrangements are provided for more than 60 folk songs. All ages.

Macaulay, David. *Cathedral: The Story of Its Construction.* Houghton, 1973. *Pyramid.* Houghton, 1975. *Castle.* Houghton, 1977. All illus. by the author. Three books describe the planning and building of a cathedral, pyramid, and castle. Intermediate and older readers.

Micklethwait, Lucy, comp. *A Child's Book of Art: Great Pictures, First Words.* Dorling Kindersley, 1993. A spacious format and brief captions in large print make the many pictures easy to absorb. Young readers.

Sills, Leslie. *Visions: Stories About Women Artists.* Whitman, 1993. Balanced treatment is accorded to the personal and professional aspects of the careers of Mary Cassatt, Leonora Carrington, Betye Saar, and Mary Frank. Intermediate readers.

Information books/hobbies and sports

Anderson, Dave. *The Story of Football.* Rev. ed. Morrow, 1997. A veteran sportswriter describes players, plays, and the history of football. *The Story of Golf.* Morrow, 1998. The writer discusses the development of golf, key players, courses, and game elements. Both books for older readers.

Björk, Christina. *Linnea's Windowsill Garden.* Trans. from the Swedish by Joan Sandin. Illus. by Lena Anderson. R & S/Farrar, 1988. A logically organized and comprehensive book guides the beginning gardener. Intermediate readers.

Boo, Michael. *The Story of Figure Skating.* Morrow, 1998. A history of figure skating includes profiles of notable performers. Intermediate readers.

Brashler, William. *The Story of Negro League Baseball.* Ticknor & Fields, 1994. The story of the league is based largely on interviews with former players and their families, and is illustrated with photographs. Intermediate and older readers.

Cole, Joanna, and others. *Fun on the Run: Travel Games and Songs.* Illus. by Alan Tiegreen. Morrow, 1999. A helpful guide gives directions for word, memory, geography, license plate, and writing games, as well as jokes, riddles, and songs for the road. Intermediate readers.

Drake, Jane, and **Love, Ann.** *The Kids Campfire Book.* Illus. by Heather Collins. Kids Can Pr., 1998. A lively, readable exploration of camping includes directions for cooking and games and a collection of campfire songs. Intermediate readers.

Gibbons, Gail. *The Pottery Place.* Illus. by the author. Harcourt, 1987. A clear explanation describes how a potter works. Young and intermediate readers.

Gutman, Bill. *Shooting Stars: The Women of Pro Basketball.* Random Hse., 1998. A survey traces women in basketball. Intermediate readers.

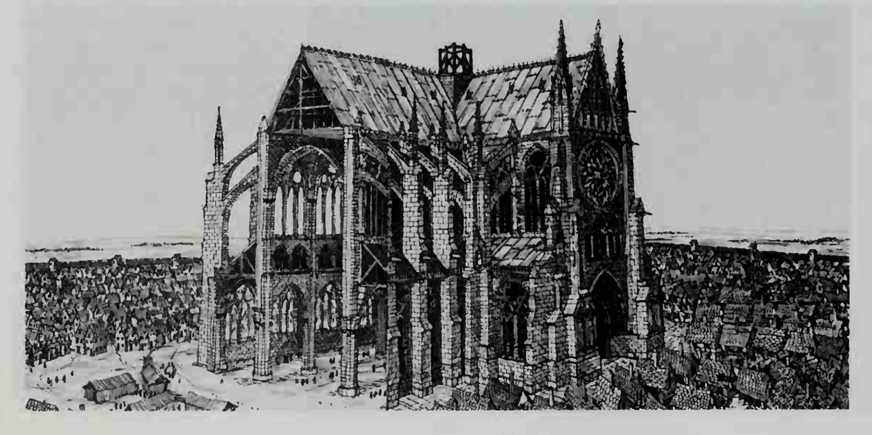
Gutman, Dan. *Gymnastics.* Viking, 1996. The author discusses the history, events, judging, and scoring of the sport and profiles some of its superstars.

Kusen, Michael. *Welcome to the Game of Chess.* Illus. by the author. Tandem, 1999. A good basic introduction explains the game. Young and intermediate readers.

Ritter, Lawrence S. *The Story of Baseball.* 3rd ed. Morrow, 1999. A history of the sport also provides overviews of such facets of the game as batting, pitching, fielding, and base running. Older readers.

Sullivan, George. *All About Hockey.* Putnam, 1998. A good overview outlines the history, rules, and techniques of the game. Intermediate and older readers.

Illustration by the author from *Cathedral* © 1973 by David Macaulay. Reprinted by permission of Houghton Mifflin Co.



An architectural book explains the Gothic architectural style of the Middle Ages through the detailed description of the construction of an imaginary cathedral in western Europe.

Information books/general nonfiction

Berck, Judith. *No Place to Be: Voices of Homeless Children.* Houghton, 1992. More than 30 homeless children tell their stories within a narrative that describes their situations. Intermediate readers.

Brown, Laurene Krasny and **Marc.** *How to Be a Friend: A Guide to Making Friends and Keeping Them.* Illus. by the authors. Little, Brown, 1998. Clear text and fun illustrations of dinosaur characters portray the value of friendship and give tips on how to be—and how not to be—a good friend. Young readers.

Day, Malcolm. *The World of Castles and Forts.* Bedrick Bks., 1996. An illustrated history traces the development of fortifications. Intermediate readers.

Duper, Linda Leeb. *160 Ways to Help the World: Community Service Projects for Young People.* Facts on File, 1996. The author describes how young people can become involved in community projects and offers specific examples and resources. Intermediate readers.

George, Jean Craighead. *How to Talk to Your Cat.* Illus. by Paul Meisel. HarperCollins, 2000. Clever pictures composed of photo cut-outs and illustrations accompany a guide to cat communication. Young readers.

Janeczko, Paul B. *How to Write Poetry.* Scholastic, 1999. A friendly handbook provides practical advice. Intermediate and older readers.

Krementz, Jill. *How It Feels When Parents Divorce.* Photos by the author. Knopf, 1984. Frank interviews with children give a range of reactions. Intermediate readers.

Kuklin, Susan. *After a Suicide: Young People Speak Up.* Putnam, 1994. Those affected by suicide tell their stories. Older readers.

Meltzer, Milton. *Weapons & Warfare: From the Stone Age to the Space Age.* Illus. by Sergio Martinez. HarperCollins, 1996. A brief social history of weapons explains how and why they were developed and discusses their impact on society. Intermediate readers.

Paulsen, Gary. *Puppies, Dogs, and Blue Northers: Reflections on Being Raised by a Pack of Sled Dogs.* Illus. by Ruth Wright Paulsen. Harcourt, 1996. The author relates his experiences and relationship with his lead sled dog and her puppies. Intermediate and older readers.

Pringle, Laurence. *Drinking: A Risky Business.* Morrow, 1997. The author discusses alcohol's history and effects as well as how to deal with peer pressure and get help. Intermediate and older readers.

Stevens, Carla. *A Book of Your Own: Keeping a Diary or Journal.* Clarion, 1993. A useful book on starting and keeping a diary or journal includes excerpts from the journals of famous people. Intermediate readers.

Weate, Jeremy. *A Young Person's Guide to Philosophy: "I Think, Therefore I Am."* Illus. by Peter Lawman. D K Pub., 1998. An introduction to philosophy discusses philosophical concepts and schools of thought as well as such thinkers as Socrates, René Descartes, and Friedrich Nietzche. Older readers.

Wick, Walter. *Walter Wick's Optical Tricks.* Scholastic., 1998. A fun presentation of optical illusions is accompanied by explanations. Intermediate and older readers.

Resources about children's literature

Adamson, Lynda G. *Literature Connections to World History, K-6: Resources to Enhance and Entice.* Lib. Unlimited, 1998. This resource guide identifies novels, biographies, history books, CD-ROM's, and videotapes in the area of history.

American Library Association, Association for Library Service to Children (ALSC). The ALSC Web site at www.ala.org/alsc offers many useful lists, including lists of books that won Newbery and Caldecott medals.

American Library Association, Young Adult Library Services Association (YALSA). The YALSA Web site at www.ala.org/yalsa is an excellent resource that includes a list of books that won the Printz Award for excellence in young adult literature.

Carter, Betty. *Best Books for Young Adults.* 2nd ed. Am. Lib. Assn., 2000. More than 1,800 classic and contemporary books are sorted into 25 themes and are also listed by author.

Children's Book Council (CBC). A Web site about children's book publishers at www.cbcbooks.org also lists children's favorites from the International Reading Association, best social studies books, and outstanding science books.

Cianciolo, Patricia J. *Picture Books for Children,* 4th ed. Am. Lib. Assn., 1997. More than 250 books are annotated and grouped by categories. *Informational Picture Books for Children.* Am. Lib. Assn., 2000. This list covers nonfiction titles.

Cullinan, Bernice E. *Read to Me: Raising Kids Who Love to Read.* Rev. ed. Scholastic, 2000. This guide summarizes developmental stages of reading and writing for children through age 12, offers tips on how to share books, and lists tried-and-true titles.

Dole, Patricia Pearl. *Children's Books About Religion.* Lib. Unlimited, 1999. A compilation lists books with spiritual themes, all published since 1990, for preschoolers through young adults.

Egoff, Sheila. *The New Republic of Childhood.* 3rd ed. Oxford, 1990. A critical guide surveys Canadian children's literature in English.

Hearne, Betsy, with **Stevenson, Deborah.** *Choosing Books for Children: A Commonsense Guide,* 3rd ed. Univ. of Illinois Pr., 1999. A friendly, reliable guide helps parents, teachers, and librarians choose books for young readers.

Hopkins, Lee Bennett. *Pass the Poetry, Please!* 3rd ed. HarperCollins, 1998. A poet discusses ways to incorporate poetry into children's daily lives, presents sketches of and interviews with poets, and offers recommendations of poetry books.

Lewis, Valerie V., and **Mayes, Walter M.** *Valerie & Walter's Best Books for Children: A Lively, Opinionated Guide.* Avon, 1998. Written by a children's bookstore owner and a storyteller, this volume includes more than 2,000 fiction and nonfiction titles with summaries arranged by reading levels.

Lipson, Eden Ross. *The New York Times Parent's Guide to the Best Books for Children.* 3rd ed. Three Rivers Pr., 2000. A children's book editor cites the top 1,001 children's books of the 1900's, organized by reading levels.

Odean, Kathleen. *Great Books for Girls: More Than 600 Books to Inspire Today's Girls and Tomorrow's Women.* Ballantine, 1997. *Great Books for Boys: More than 600 Books for Boys 2 to 14.* Ballantine, 1998. A librarian recommends titles and offers strategies to parents and educators about promoting reading among girls and boys.

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American authors

Alcott, Louisa May
Alexander, Lloyd
Alger, Horatio
Baum, L. Frank
Beard, Daniel
Blume, Judy
Bontemps, Arna
Brink, Carol
Brooks, Gwendolyn
Burgess, Thornton
Burnett, Frances H.
Byars, Betsy

Cleary, Beverly
Coatsworth, Elizabeth
Cooper, James Fenimore
Cooper, Susan
Daugherty, James
De Angeli, Marguerite
Dodge, Mary Elizabeth Mapes
Enright, Elizabeth
Field, Eugene
Field, Rachel
Finger, Charles
Forbes, Esther
Fox, Paula
Hamilton, Virginia
Hawthorne, Nathaniel
Heinlein, Robert A.
Hinton, S. E.
Irving, Washington
Konigsburg, Elaine
Lawson, Robert
Le Guin, Ursula K.
L'Engle, Madeleine
Lobel, Arnold
Lofting, Hugh
London, Jack
Longfellow, Henry Wadsworth
Lowry, Lois
McCord, David
Moore, Clement Clarke
Norton, Andre
O'Brien, Robert C.
O'Dell, Scott
O'Hara, Mary
Paterson, Katherine
Raskin, Ellen
Richards, Laura
Sawyer, Ruth
Selsam, Millicent E.
Sendak, Maurice
Seton, Ernest Thompson
Seuss, Dr.
Silverstein, Shel
Singer, Isaac Bashevis
Speare, Elizabeth George
Stine, R. L.
Stockton, Frank
Stratemeyer, Edward
Tarkington, Booth
Taylor, Mildred D.
Twain, Mark
Van Allsburg, Chris
White, E. B.
Whittier, John Greenleaf
Wiggin, Kate
Wilder, Laura Ingalls
Yates, Elizabeth

American illustrators

Bemelmans, Ludwig
Brown, Marcia
D'Aulaire (family)
DePaola, Tomie
Duvoisin, Roger
Hogrogian, Nonny
Lawson, Robert
Lobel, Arnold
Milhous, Katherine
Pyle, Howard
Sendak, Maurice
Seuss, Dr.
Shulevitz, Uri
Ward, Lynd K.
Weisgard, Leonard

British authors and illustrators

Ardizzone, Edward
Barrie, J. M.
Belloc, Hilaire
Brooke, Leonard Leslie
Bunyan, John
Caldecott, Randolph
Carroll, Lewis
Crane, Walter
Cruikshank, George
Dahl, Roald
Defoe, Daniel
De la Mare, Walter
Dickens, Charles
Farjeon, Eleanor
Fleming, Ian Lancaster
Grahame, Kenneth
Greenaway, Kate
Haggard, H. Rider
Hughes, Thomas
Jacobs, Joseph
Kipling, Rudyard
Knight, Eric
Lamb, Charles (Mary Ann)
Lang, Andrew
Lear, Edward
Lewis, C. S.
Milne, A. A.
Newbery, John
Potter, Beatrix
Rackham, Arthur
Ransome, Arthur
Rowling, J. K.
Scott, Sir Walter
Sewell, Anna
Shepard, Ernest Howard
Stevenson, Robert Louis
Swift, Jonathan
Tenniel, Sir John
Tolkien, J. R. R.

Other authors and illustrators

Andersen, Hans Christian
Collodi, Carlo
Colum, Padraic
Comenius, John Amos
Grimm
La Fontaine, Jean de
Perrault, Charles
Spyri, Johanna
Travers, P. L.
Verne, Jules
Wyss family

Characters and works

Aesop's fables
Appleseed, Johnny
Arabian Nights
Arthur, King
Bunyan, Paul
Grimm's Fairy Tales
Gulliver's Travels
Lancelot, Sir
Merlin
Mother Goose
Peter Pan
Pied Piper of Hamelin
Potter, Harry
Robin Hood
Robinson Crusoe

Other related articles

Ballad
Book
Caldecott Medal
Encyclopedia
Epic
Fable
Fairy
Folklore
Hornbook
Library
Melcher, Frederic
Mythology
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Nursery rhyme
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Why was the *St. Nicholas* magazine significant?
Who was John Newbery?
What is the Printz Award?

Litharge, *LIHTH ahrj,* also called *lead monoxide* (chemical formula, PbO), is a poisonous yellow or reddish-yellow solid, a compound of lead and oxygen. It is made by heating lead or certain lead compounds in air. Litharge is used in making lead glass, pottery glazes, and rubber. Harriet V. Taylor

Lithium, *LIHTH ee uhm,* is a soft, silvery-white metallic element, the lightest known metal. It is only half as heavy as an equal volume of water. It reacts with water, as does sodium, to release hydrogen gas. But, unlike sodium, the reaction usually does not ignite the hydrogen. Lithium is used to make certain types of batteries. Lithium compounds are used in the manufacture of various materials, including ceramic products, enamels, glass, and lubricants for use at high temperatures. They also are used in rubber products and in dyes for textiles. One compound, lithium carbonate, is used as a drug to treat a mental illness known as *bipolar disorder,* also called *manic-depressive illness* (see **Bipolar disorder**).

Lithium metal does not occur in nature because it combines easily with other elements. Chemists obtain the metal by passing electric current through *fused* (melted) lithium chloride. The chemical symbol for lithium is Li. Its atomic number is 3, and its atomic weight is 6.941. Lithium melts at 180.54 °C and boils at 1347 °C. It was discovered in 1817 by Johann August Arfvedson, a Swedish chemist. Duward F. Shriver

See also **Alkali; Element, Chemical.**





WORLD BOOK photos by Dan Miller

Making a lithograph. The artist draws on a lithographic stone with a greasy crayon. The artist dampens the stone with water and applies ink that sticks to the drawing but not to the rest of the stone. Then a sheet of paper is pressed against the inked stone to make a print.

Lithography is a printing process that has an important part in the fine arts and in commercial printing. Many artists have created lithographs that rank among the masterpieces of printmaking. Commercially, lithography is a leading method of printing books, magazines, newspapers, and other publications.

This article describes lithography in the fine arts. For information on commercial lithography, see the article on **Printing** (Offset lithography).

How lithography works. Lithography is based on the principle that water does not mix with grease. The artist draws the picture on a level porous surface with a grease pencil, a crayon, or a greasy liquid called *tusche.* The most common surfaces are limestone or a plate made of a material such as aluminum, paper, or zinc with a specially prepared surface. The grain of the stone or plate enables the artist to create lithographs with a broad range of tones and textures.

After drawing the picture, the artist treats both the drawn and undrawn areas of the surface with solutions of nitric acid and gum arabic. The gum arabic surrounds the grease drawing and chemically prevents ink from sticking to the undrawn areas. The acid allows the grease and gum arabic to be more easily absorbed into the pores of the stone or plate. After applying the solutions, the artist uses turpentine to remove the drawing materials that remain on the surface of the stone or plate.

The artist then dampens the surface with water. The undrawn areas absorb water, but the greasy drawn areas reject it. The artist applies an oil-base ink to the surface with a roller. The ink sticks to the greasy areas but not to the wet ones.

Next, the artist places a sheet of paper on the printing surface and runs the paper and the stone or plate through a printing press under heavy pressure. The pressure transfers the inked design onto the paper. To make additional impressions of the picture, the artist again dampens and inks the surface.

The Art Institute of Chicago, Glore Collection (WORLD BOOK photo)

A color lithograph by Henri de Toulouse-Lautrec, a French artist, decorated an 1893 magazine cover. The printer operates a lithographic press while his customer examines a proof.

Color lithography. To make a lithograph in more than one color, the artist must prepare a separate surface for each color. For example, the picture may show green grass and a red house. On one surface, the artist draws the grass, which is printed with green ink. The house is drawn on a second stone or plate and then printed in red ink. The artist puts the paper through the press twice, once for each color of the total design. The artist must draw the grass and house so they appear in exactly the correct *registration* (relationship to each other) in the lithograph. Images printed from limestone or zinc plates produce colored pictures having an especially luminous quality.

History. Alois Senefelder, a German, invented lithography in 1798. European painters soon began exploring the artistic possibilities of the new medium. They particularly liked the spontaneous effects they could achieve by drawing directly on the printing surface.

The first masters of lithography included the French artists Eugène Delacroix and Honoré Daumier. During the late 1800's, the French painters Pierre Bonnard, Henri de Toulouse-Lautrec, and Edouard Vuillard raised color lithography to new heights of expression and refinement. Leading lithographers of the 1900's included Marc Chagall and Pablo Picasso in Europe, and Jasper Johns and Joseph Pennell in the United States. Today, artists achieve unusual effects by combining lithography with other printmaking processes, such as silk-screen printing.

Andrew J. Stasik, Jr.

See also **Cartoon** (picture: Many early cartoons); **Currier and Ives; Daumier, Honoré; Escher, M. C.; Screen printing; Senefelder, Alois.**

Lithosphere. See **Plate tectonics.**

Lithuania, *lih thoo AY nee uh,* is a country on the Baltic Sea in northeastern Europe. Its name in Lithuanian, the official language, is *Lietuvos Respublika* (Republic of Lithuania). Vilnius is the capital and largest city.

The Lithuanian peoples united into a single nation in the late 1100's. From the late 1300's until the 1700's, Lithuania was united with Poland. Russia ruled the country from the late 1700's until 1918, when Lithuania declared independence. In 1940, the Soviet Union occupied Lithuania and forced it to become one of the 15 republics of the Soviet Union. Lithuania regained independence in 1991, the year the Soviet Union dissolved.

Government. Lithuania is a republic. The president is the highest government official and is elected by the people to a five-year term. The president appoints a prime minister with the approval of the parliament. A cabinet of ministers helps carry out the operations of government. Lithuania's parliament has 141 members, who are elected by the people to four-year terms. All citizens age 18 or older may vote.

The Supreme Court is Lithuania's highest court. Other courts include the Court of Appeals and the Constitutional Court.

Lithuania's largest political party is the moderately conservative Homeland Union Party. Other parties include the Christian Democratic Party and the Lithuanian Democratic Labor Party, formerly the Communist Party.

People. About 80 percent of the people of Lithuania are Lithuanians, a nationality group that has its own customs and language. Most of the rest of the people are Russians or Poles. Lithuania also has a small number of Belarusians and Ukrainians.

About 90 percent of the people of Lithuania are Roman Catholics. Most others belong to the Lutheran Church or another Protestant denomination. The nation also has a small number of Jews. Lithuania's culture developed under Roman Catholic influence, and Catholic traditions remain part of the people's lives.

Most people live in urban areas and wear Western-style clothing. But Lithuanians cherish their decorative national costumes and wear them on festive occasions.

For recreation, Lithuanians especially enjoy singing and sports, particularly basketball, boxing, rowing, and soccer. Choral singing is highly developed in Lithuania, and thousands of people sing and dance in annual festivals that attract huge crowds. Many folk tales as well as ancient Lithuanian songs, called *dainos,* have been handed down in spoken form for generations.

Children are required to attend school from the age of 6 to 16. Lithuania has 15 schools of higher education. The State University in Vilnius is the oldest university. It was established in 1579.

Land and climate. Most of Lithuania consists of flat or gently sloping land. The highest elevations are in the southeast. The land dips down to central lowlands and rises slightly in the west.

Lithuania, Latvia, and Estonia, which all border the Baltic, are often called the Baltic States. White sand dunes along Lithuania's Baltic coast provide a popular





Symbols of Lithuania. Lithuania's flag has three horizontal stripes. The yellow stripe stands for fields of ripening grain. The green stripe represents Lithuania's evergreen forests. The red stripe symbolizes the blood shed for freedom. Lithuania's coat of arms features a knight on a white horse.

Facts in brief

Capital: Vilnius.
Official language: Lithuanian.
Official name: Lietuvos Respublika (Republic of Lithuania).
Area: 25,174 mi² (65,200 km²). *Greatest distances*—north-south, 175 mi (280 km); east-west, 235 mi (375 km).
Elevation: *Highest*—Juozapines (hill), 958 ft (292 m). *Lowest*—sea level along the coast.
Population: *Estimated 2002 population*—3,647,000; density, 145 per mi² (56 per km²); distribution, 68 percent urban, 32 percent rural. *1989 census*—3,674,802.
Chief products: *Agriculture*—beef cattle, dairy products, hogs. *Manufacturing*—chemicals, electrical equipment, electronic products, fabricated metal products, machinery, processed foods, textiles, wood products
Money: *Basic unit*—litas. One hundred centas equal one litas.

TASS from Sovfoto



Vilnius, the capital and largest city of Lithuania, lies along the Neris River. The city is a major cultural and industrial center. It is famous for its many old churches, some of which date from the 1400's. Modern high-rise buildings stand among the older structures.



TASS from Sovfoto

Traditional folk costumes brighten special Lithuanian celebrations, such as the festival shown here. But Lithuanians usually dress much as people in Western countries do.

resort area. The dunes are especially attractive on a long strip of land that separates a lagoon from the Baltic Sea.

Lithuania has about 3,000 small lakes and hundreds of rivers. The longest and largest river is the Neman (called Nemunas in Lithuanian). It begins in Belarus and drains most of Lithuania during its course to the Baltic. Forests cover about a fourth of the land.

In January, Lithuania's coldest month, the temperature averages from about 27 °F (23 °C) near the sea to 21 °F (26 °C) in the east. In July, the hottest month, temperatures average 61 °F (16 °C) at the sea and 64 °F (18 °C) in the east. The average annual precipitation ranges from 21 inches (53 centimeters) to 34 inches (86 centimeters).

Economy. Service industries employ about half of Lithuania's workers. The main service industries include wholesale and retail trade; transportation, communication, and utilities; and finance, insurance, and real estate.

Manufacturing employs about a fifth of the workers. Lithuania's manufactured products include chemicals, electronic products, machinery, processed foods, textiles, and wood products. The country produces large numbers of metal-cutting lathes and electric motors used in appliances. It also has a number of appliance factories. Kaunas, Klaipėda, Vilnius, Šiauliai, and Panevėžys are the major industrial centers. Klaipėda has large shipyards. Lithuania also has a large fishing fleet.

Lithuanian agriculture specializes in dairy and meat production. Its farm products include beef cattle, dairy products, hogs, potatoes, and sugar beets.

The country's natural resources include chalk, clay, dolomite, gravel, limestone, and peat. Small quantities of oil have been discovered in western Lithuania and offshore in the Baltic Sea.

History. People lived in the region that is now Lithuania in 8000 B.C. Groups that were the ancestors of the Lithuanian people lived there by about 2,000 years ago.

In the A.D. 100's, the Roman historian Tacitus made the first historical mention of the people who lived near the Baltic Sea. He stated they sold amber to the Romans.

Early leaders. Near the end of the 1100's, the Lithuanian peoples united into a single nation. The first great ruler was Mindaugas, who became king in 1251. Mindaugas was assassinated by nobles in 1263.

In the 1200's, the people fought a group of German crusaders called the Teutonic Knights, who tried to conquer Lithuania (see **Teutonic Knights**). Lithuania expanded its boundaries in the 1300's. In time, it extended nearly to the city of Moscow in the east and to the Black Sea in the south. In 1386, Grand Duke Jagiello (Jogaila in Lithuanian) united Lithuania with Poland. At first, this union was a confederation of two states ruled mostly by

Lithuania







WORLD BOOK maps

the same king. They were made a single state in 1569.

Russian rule. The Lithuanian-Polish government collapsed in the 1700's, and in 1795, Lithuania came under the rule of the czar of Russia. The people rebelled against Russian rule in 1831 and again in 1863 but failed to win independence. The czar tried to increase Russian influence in Lithuania. He prohibited books printed in Lithuanian and closed Lithuanian schools. But the people continued to educate their children and kept the national culture alive as well. Many Lithuanians emigrated to the United States during this period and later periods.

Independence. The movement for an independent Lithuania became organized in the 1880's. In 1905, a conference of elected representatives of Lithuania demanded self-government for their people within the Russian state. The Russians rejected this demand. During World War I (1914-1918), German troops occupied Lithuania. On Feb. 16, 1918, Lithuania became the first of the Baltic States to declare its independence from Russia and Germany. Lithuania established a democratic system of government in which the parliament had power over the president. A land-reform program broke up large estates and distributed land among the poor. The government also set up an educational system.

Fighting continued in Lithuania after World War I ended. Russia attempted to take over the country. The Lithuanians defeated Russia, and a peace treaty was signed in 1920. Poland occupied Vilnius from 1920 to 1939. In 1926, a group of military officers and civilian politicians seized power. Antanas Smetona became president. He gradually took over more of the authority that the president had shared with parliament.

In March 1939, Germany seized part of Lithuania. A combination of Lithuanian political parties tried to restore democracy, but failed. Later in 1939, Germany and the Soviet Union agreed to divide much of eastern Europe between them. (The Soviet Union had been formed in 1922 under Russia's leadership.) The agreements gave the Soviet Union control of the Baltic region. The Soviets then built some military bases in Lithuania.

Soviet republic. In 1940, during World War II, the Soviet Union occupied Lithuania and made it a Soviet republic with a Communist government. After the Germans invaded the Soviet Union in 1941, the Lithuanians revolted against their Soviet rulers and established their own government. But the Germans suppressed the government. They conquered Lithuania and occupied it until 1944, when the Soviet Union again took it over.

Until the Soviet conquest, Lithuania was a rural society. About three-fourths of the people lived in small villages. The Soviet government ended the traditional Lithuanian style of life by industrializing the country. The government took away private land and combined small farms into large state-owned farms. It built many factories, and large numbers of people moved from rural areas into cities to work in these factories

The Soviets made the practice of many of the old Lithuanian customs difficult. For example, Soviet laws forbade religious instruction, religious publications, and charity work. The government also discouraged church attendance. People who attended church were kept from good educational and employment opportunities.

Resistance to Soviet rule. From the time of the Soviet take-over in 1944 to 1952, Lithuanian guerrillas fought the Soviets. Thousands of guerrillas were killed in the fighting. The Soviet government sent about 350,000 Lithuanians to labor camps in Siberia for their political beliefs or as punishment for resisting Soviet rule.

In 1972, many Lithuanian students and young workers demonstrated against the Soviet government, and several people burned themselves to death in protest. Lithuanians continued to express opposition to Soviet rule, particularly after the mid-1980's, when the leader of the Soviet Union, Mikhail Gorbachev, began calling for more openness in Soviet society.

In 1988, Lithuanian intellectuals set up the Sajudis, a non-Communist movement to give Lithuania complete control of its economy, citizenship requirements, education, and cultural development. The Sajudis sought to clean up rivers, lakes, and the Baltic Sea shores, all of which had been severely damaged by industrial pollution. Most members of this and similar movements sought total independence and separation from the Soviet Union. Lithuanians supported these goals by staging public demonstrations. They elected supporters of independence as representatives to the Soviet parliament that was created in 1989.

In 1989, Lithuania's parliament expressed a commitment to full independence. It declared that laws adopted by the Soviet parliament were invalid in Lithuania unless approved by the Lithuanian parliament. The government declared Lithuanian the official language. Russian had been the official language under the Soviets. The government also allowed freedom of religion and the press.

On Dec. 7, 1989, the Lithuanian parliament abolished the monopoly of power that the Communist Party had held since 1940. It established a multiparty political system. Parliamentary elections were held in February 1990. A pro-independence coalition led by Sajudis won over 90 percent of the parliamentary seats.

On March 11, the new parliament declared an immediate restoration of Lithuania's independence as a nation. The Soviet Union demanded a recall of the declaration, but the Lithuanians refused. In response, the Soviet Union applied economic pressure. It cut off all its shipments of oil, medical supplies, and many other goods. In June—under pressure from Western nations—the Soviet Union and Lithuania held talks that led to an agreement. Under the agreement, the Soviets restored shipments of raw materials and other goods to Lithuania. In turn, the Lithuanians agreed to suspend their declaration of independence temporarily if negotiations with the Soviets took place. But in January 1991, Soviet forces moved into Lithuania to crack down on the freely elected government and the independence movement. The forces killed 14 people and injured 700 others.

Independence regained. In August 1991, several conservative Communist officials failed in an attempt to overthrow Gorbachev and take over the Soviet government. After the failed coup, Lithuania pressed the Soviet Union for recognition of its independence. In September, the Soviet government recognized Lithuania's independence. In December, most of the republics formed a loose association called the Commonwealth of Independent States, and the Soviet Union was dissolved. Lithuania and the other Baltic States declined to join the association, however, because they feared that Russia would have too much influence over the group.



© Ricki Rosen, SABA

Lithuanians celebrated independence in September 1991, when the Soviet Union recognized Lithuania as an independent nation. Lithuania had been under Soviet rule for over 50 years.

After achieving independence, Lithuania quickened the pace of economic reform, which had begun in the late 1980's. The changes brought economic hardship. In 1992, the economic problems helped cause the Sajudis coalition to lose control of parliament.

Recent developments. By the mid-1990's, many of Lithuania's businesses had become privately owned, and much farmland was under private control. Lithuania sought to strengthen its ties to Europe. It worked toward membership in the European Union, which promotes economic and political cooperation, and the North Atlantic Treaty Organization, a defense alliance.

Jaroslaw Bilocerkowycz

See also **Baltic States; Kaunas; Klaipėda; Vilnius.**

Litmus is a substance that is commonly used in chemistry to indicate whether a solution is an acid or a base. It can be prepared in an acidic form, which is red, and in a basic form, which is blue. An acidic solution will turn blue litmus red, but will not affect red litmus. A basic solution will turn red litmus blue, but will not affect blue litmus. A neutral solution, which is neither acidic nor basic, will not change the color of either litmus.

Litmus may be dissolved in water or alcohol to make an *indicating solution.* Litmus is an intensely colored substance, so only a few drops of litmus indicator need to be added to a solution to tell whether it is acidic or basic. Litmus indicator is also used when a solution is being neutralized. For example, it will turn an acidic solution red. In order to neutralize the acid, base is slowly added. When the solution becomes neutral, the litmus indicator will turn purple. If more base is added, the solution will become basic, and the litmus will turn blue.

Litmus may also be added to absorbent paper to make *litmus paper.* Litmus paper is blue or red, depending on which form of litmus is present. When a drop of solution is placed on the paper, the color will indicate whether the solution is acidic, basic, or neutral.

Litmus is extracted from organisms called *lichens.* It was once used as a dye and in coloring beverages. Today, litmus is also used as a stain to make specimens easier to view under a microscope. Emily Jane Rose

See also **Acid; Base; Neutralization.**

Litre. See **Liter.**

Little Bighorn, Battle of. See **Crazy Horse; Custer, George A.; Gall; Reno, Marcus A.**

Little Bighorn Battlefield National Monument is in southeastern Montana. It includes part of the site of the Battle of the Little Bighorn, which took place on June 25, 1876. It was established as a national cemetery in 1879 and became a national monument in 1946. The cemetery is Custer National Cemetery. The monument was called Custer Battlefield National Monument until 1991. For the area of the Little Bighorn Battlefield National Monument, see **National Park System** (table: National monuments). Critically reviewed by the National Park Service

See also **Montana** (picture).

Little Dipper. See **Big and Little Dippers.**

Little League Baseball is an organization of baseball and softball programs for boys and girls 5 to 18 years of age. It is also the name of the organization's major division baseball program for 9- to 12-year-olds. Each division may include minor league teams for younger players with less experience. Both boys and girls may play in the baseball programs, but most participants are boys. There are separate boys and girls softball programs.

In all divisions, local leagues may have 4 to 10 teams. Each team may include 12 to 15 players. Teams play at least 15 games a season to determine the league champion. An all-star team selected from league teams competes in tournament play after the regular season.

Players in the Little League Baseball division use a diamond two-thirds the size of a regulation baseball diamond, and games last six innings instead of nine. Players on tournament teams must be 11 or 12 years old. The tournaments determine eight regional champions—four from the United States and one each from Canada, Europe, Latin America, and the Far East. The regional winners participate in the Little League World Series at South Williamsport, Pennsylvania.

Other baseball programs in Little League include Tee Ball for youngsters 5 to 8 years of age; Junior League, a transitional division for 13-year-olds; Senior League for players 13 to 15; and Big League for players 16 to 18. The divisions for players 13 and older use an adult-sized baseball diamond. The Junior League World Series is held in Taylor, Michigan. The Senior League World Series is played in Kissimmee, Florida, and the Big League World Series is held in Fort Lauderdale, Florida.

Age divisions for softball are the same as baseball. The World Series for Big League and Senior League Softball divisions is in Kalamazoo, Michigan. The Little League Softball World Series is in Portland, Oregon.

The Little League program was developed by Carl Stotz and George and Bert Bebble in 1939. Headquarters are in South Williamsport, Pennsylvania.

Critically reviewed by Little League Baseball, Inc.

Little Rock (pop. 183,133; met. area pop. 583,845) is the capital and largest city of Arkansas. It ranks as the state's chief trading and transportation center (see **Arkansas** [political map]). William Russell, a land speculator, established Little Rock in 1820. The site lay on the smaller of two rock bluffs that flank the Arkansas River. This bluff had been named *petit roche* (meaning *little rock*) by the French explorer Bernard de La Harpe in 1722.

Description. Little Rock is the seat of Pulaski County. It covers 103 square miles (267 square kilometers) on the Arkansas River's south bank, including 4 square miles (10 square kilometers) of inland water. North Little Rock lies across the river. Little Rock and North Little Rock form a metropolitan area that covers 3,005 square miles (7,783 square kilometers) and consists of Faulkner, Lonoke, Pulaski, and Saline counties.

The central business district of Little Rock has an interesting mixture of historic and modern buildings. It includes the Arkansas Territorial Restoration, a city block that shows how Little Rock looked in the 1820's. The first State Capitol, built in the 1830's, also stands in downtown Little Rock. The present Capitol was completed in 1915. It is located near the downtown area of the city.

Little Rock has about 90 public and private schools. In 1969, Little Rock University merged with the University of Arkansas system to form the University of Arkansas at Little Rock. Other schools include Arkansas Baptist College and Philander Smith College. The state operates schools for the deaf and the blind in Little Rock. The Arkansas Arts Center and the Museum of Science and History are located downtown.

Little Rock is the home of the Arkansas Symphony Orchestra and Ballet Arkansas. War Memorial Park has a 33-acre (13-hectare) zoo. The Arkansas State Fair and Livestock Exposition takes place in Little Rock in October. Little Rock Air Force Base lies northeast of the city.

Economy. Service industries and manufacturing are important to Little Rock's economy. Service industries include wholesale and retail trade, government activities, health care, and finance. The Little Rock-North Little Rock metropolitan area has nine major hospitals. Little Rock is Arkansas's financial center. Chief manufactured products include data transmission equipment, valves and pipes, aircraft, sporting ammunition, electric motors, watches, and clothing. Little Rock is a main market in Arkansas for cotton, rice, and soybeans. The city is also one of the state's chief ports.

Three railroads provide freight service and Amtrak provides passenger train service for Little Rock. Airlines use Little Rock National Airport, near downtown.

Government. Little Rock has a council-manager government. Voters elect the seven members of the council to four-year terms. The council hires a city manager to carry out policies established by the group.

History. The Quapaw Indians lived in what is now the Little Rock area before white explorers first arrived there. In 1820, the legislature of the Arkansas Territory chose Little Rock as the territorial capital. About 50 people lived there. The town became the territorial capital in 1821 and the state capital in 1836, when Arkansas achieved statehood. Little Rock's location on the Arkansas River and its role as capital led to its growth as a trading center. By 1860, it had a population of 3,727. After the Civil War began in 1861, Confederate troops occupied the Army post at Little Rock and used the city as a supply center. Federal forces captured the city in 1863.

After the war ended in 1865, Little Rock prospered as a cotton and lumber market and as Arkansas's chief center of trade. By 1900, its population had grown to 38,039. Little Rock grew steadily during the first half of the 1900's, and its population reached 88,129 by 1940. After World War II ended in 1945, increased industrialization and government employment brought further growth. By 1960, the population had grown to 107,813.

In 1957, Governor Orval E. Faubus attracted worldwide attention to Little Rock when he tried to prevent integration of the city's Central High School (see **Arkansas** [The mid-1900's]). Completion of a federal navigation project on the Arkansas River in 1968 enabled barges to reach Little Rock. As a result, the city became an important port on the Arkansas River Navigation System. Since the 1960's, the city's population has continued to grow, reaching 183,133 by 2000. In 1982, Little Rock completed a convention center and hotel complex overlooking the river. The 40-story TCBY Tower office building opened in 1986. It is the state's tallest building.

In 1998, construction began on an 18,000-seat arena along the Arkansas River in the downtown area. It was completed in 1999. Ray D. Hobbs

For the monthly weather, see **Arkansas** (Climate).

Little Sisters of the Poor is a religious congregation of women in the Roman Catholic Church. It is dedicated to providing the aged poor with respectful care and attention until death. The congregation was founded in 1839 in St. Servan, France, by Jeanne Jugan. Today, it has about 250 homes in 30 countries, including the United States and Canada. The mother house is in St. Pern, France, near Rennes. Anne E. Carr

Little Turtle (1752-1812) was a Miami Indian chief in what is now Indiana and Ohio. He fought United States troops to protect the tribe's lands. His forces defeated General Josiah Harmar's troops in 1790, and drove back forces led by General Arthur St. Clair in 1791. Historians once believed Little Turtle was the Indian leader at the Battle of Fallen Timbers (1794). In the battle, Major General "Mad Anthony" Wayne's troops defeated nearly 2,000 Indians near what is now Toledo, Ohio. But recent research indicates Little Turtle was not in command. In 1795, Little Turtle and other Indians signed a treaty that opened southern Ohio to settlement. He was born near the Eel River in what is now Indiana. Terry P. Wilson

Liturgy, *LIHT uhr jee,* is a term that refers to acts of worship that are performed by the members of a religious group. A liturgy is also called a *rite* or a *ritual.* Most religions have their own liturgy. But within a religion, various churches and denominations may develop their own kinds of liturgy. A liturgy may combine words, music, and gestures. It also may include religious objects, such as altars and special clothing; and symbolic acts, such as pouring or sprinkling water as part of the ceremony of baptism. Some liturgical services are held at certain times of the day, week, or year. They may take place on a fast day, festival, or Sabbath.

The principal liturgical service in Christianity is called the Eucharist, Holy Communion, the Lord's Supper, or the Mass. The Eastern churches call the Eucharist the Divine Liturgy. The most important events of the Christian liturgical year are Christmas and Easter. The main annual services in the Jewish liturgy are Rosh Ha-Shanah and Yom Kippur.

Christianity has many forms of liturgy. The most widespread ones are the Byzantine rite and the Latin, or Roman, rite. The Byzantine rite is used by the Greek Orthodox Church and several other Eastern churches. The Latin rite is used by the Roman Catholic Church.

Today, most Western Christian liturgies are undergo-

ing reform in both style and text. The reforms include a stronger emphasis on the Bible and more involvement of the congregation. Stanley K. Stowers

See also **Communion; Eastern Orthodox Churches** (Services); **Mass; Roman Catholic Church** (Worship); **Sacrament.**

Liu Bang, *lyoh bahng,* also spelled *Liu Pang* (248?-195 B.C.), was a Chinese emperor who founded the Han dynasty (202 B.C.-A.D. 220). He is also known as Han Gaozu (Han Kao-tsu). Liu was the first commoner to become emperor. He reigned from 202 to 195 B.C.

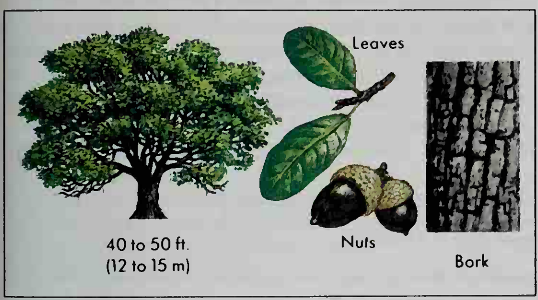
Liu revived feudalism in China by setting up regional kingdoms, with the rulers controlled by the central government. He was a skillful politician and made peace with tribes that were invading China from Mongolia. Liu was often cruel and ruthless, but he eliminated many harsh laws. He was uneducated and scorned scholars. But by the end of his reign, he allowed a few scholars to hold minor government positions.

Liu, a farmer's son, was born near Xuzhou (Hsu-chou) in Jiangsu province. He became one of the generals who led revolutionary forces against the Qin (Ch'in) dynasty from 209 to 206 B.C. The name Han Gaozu identifies Liu as "great ancestor" of the Han dynasty. Grant Hardy

See also **Han dynasty.**

Live-forever. See **Houseleek; Sedum.**

Live oak is a beautiful evergreen oak that grows chiefly along the southeastern coast of the United States. It is also found in dry parts of Texas. The tree grows about 50 feet (15 meters) high. Its horizontal limbs form a wide-spreading, dense head. The dark, glossy, oblong leaves



WORLD BOOK illustration by John D. Dawson

The live oak grows in the Southeastern States.

may be 2 to 5 inches (5 to 13 centimeters) long. The live oak is a favorite tree for lawns and streets because it resists damage from storms, insects, and diseases. It is the state tree of Georgia. Norman L. Christensen, Jr.

Scientific classification. The live oak is a member of the beech family, Fagaceae. It is classified as *Quercus virginiana.*

See also **Oak** (Red oaks); **Tree** (Familiar broadleaf and needleleaf trees [picture]).

Liver is the largest gland in the human body and one of the most complex of all human organs. It serves as the body's main chemical factory and is one of its major storehouses of food. The liver is a reddish-brown mass weighing about 3 pounds (1.4 kilograms). It is located in the upper right part of the abdomen, under the diaphragm and above the stomach and intestines.

The liver performs many essential functions. One of its most important tasks is to help the body digest food. The liver produces and discharges *bile,* a greenish-yellow digestive fluid. Bile travels from the liver to the small intestine, where it aids in the digestion of fats. Extra bile is stored in the *gallbladder,* a pear-shaped pouch that lies under the liver.

The liver also stores food. Digested food travels in the blood from the small intestine to the liver. The liver removes some of the digested food from the blood and stores it. When the body needs food, the liver releases it into the blood. The liver also changes some digested food into compounds needed by the body's cells.

In addition, the liver filters poisons and wastes from the blood. Some substances produced by the liver help the body fight disease. Others enable the blood to clot.

The liver has a remarkable ability to produce new cells to replace its own diseased or damaged cells. For example, surgeons can remove a section of a healthy liver from an adult and transplant it into a child who has a diseased liver. The adult's liver will rapidly regenerate and be restored to full size. The child's new liver will grow as the child grows.

Structure of the liver

The liver consists of four sections, or *lobes.* There are two main lobes—the right lobe, which is by far the larger, and the left lobe. Two small lobes lie behind the right lobe. Each lobe is made up of multisided units called *lobules.* Most livers have between 50,000 and 100,000 lobules. Each lobule consists of a central vein surrounded by tiny liver cells grouped in sheets or bundles. These cells perform the work of the liver. Cavities known as *sinusoids* separate the groups of cells within a lobule. The sinusoids give the liver a spongy texture and enable it to hold large amounts of blood.

The liver has an unusual blood supply system. Like other organs, the liver receives blood containing oxygen from the heart. This blood enters the liver through the *hepatic artery.* The liver also receives blood filled with *nutrients,* or digested food particles, from the small intestine. This blood enters the liver through the *portal vein.* In the liver, the hepatic artery and the portal vein branch into a network of tiny blood vessels that empty into the sinusoids.

The liver cells absorb nutrients and oxygen from the blood as it flows through the sinusoids. They also filter out wastes and poisons. At the same time, they secrete sugar, vitamins, minerals, and other substances into the blood. The sinusoids drain into the central veins, which join to form the *hepatic vein.* Blood leaves the liver through the hepatic vein.

Each lobule also contains *bile capillaries,* tiny tubes that carry the bile secreted by the liver cells. The bile capillaries join to form *bile ducts,* which carry bile out of the liver. Soon after leaving the liver, the bile ducts join, forming the *hepatic duct.* The liver manufactures bile continuously, even if the small intestine is not digesting food. Excess bile flows into the gallbladder, where it is stored for later use. Bile from the liver and gallbladder flows into the small intestine through the *common bile duct.*

Functions of the liver

The liver probably performs more separate tasks than any other organ in the body. Its chief functions are to

help the body digest and use food and to help purify the blood of wastes and poisons.

Digestion and use of food. The secretion of bile ranks as one of the liver's most important digestive functions. Bile consists of bile salts and several other substances. The bile salts act on fats in the small intestine. They help break up globs of fat so enzymes in the intestine can convert fat molecules to fatty acids and glycerol.

The liver also regulates the amount of certain nutrients that the cells of the body receive. Digestive enzymes in the intestine break down proteins into amino acids, and carbohydrates into simple sugars, primarily glucose. The blood carries these nutrients, as well as vitamins, minerals, and fatty acids and glycerol, to the liver. The liver removes the excess glucose from the blood and stores it in the form of a starchlike compound called *glycogen.* Glucose serves as the chief fuel for the body's cells. When the body needs energy, the liver converts glycogen to glucose and releases it into the blood. The liver also converts fatty acids and amino acids into glucose when its store of glycogen is low. In this way, the liver helps ensure that the cells of the body receive a constant supply of fuel.

The liver also plays an essential role in the storage of certain vitamins. The liver stores vitamin A, as well as vitamins D, E, and K, and those of the B-complex group. It also stores iron and other minerals.

Purification of the blood. Liver cells filter harmful substances from the blood. Such substances include insecticides, drugs, food additives, and industrial chemicals. Enzymes in the liver cells convert some of these substances into products that dissolve in water. The blood transports the substances to the kidneys, which discharge them in urine. Other harmful substances are excreted in the bile. The liver also filters many bacteria, viruses, and other microorganisms from the blood. Special liver cells surround these microorganisms and chemically digest them.

In addition, the liver filters out waste substances produced by the body. When red blood cells die, they release *hemoglobin,* the compound that enables them to carry oxygen. Cells in the liver and other organs break down hemoglobin into several substances, including iron and a reddish-yellow pigment called *bilirubin.* The liver discharges bilirubin in bile. It stores iron for use in producing new red blood cells. The liver also rids the body of *ammonia,* a poisonous waste formed when amino acids are changed to other compounds in the liver. The liver converts the ammonia to *urea,* which is eventually discharged in urine.

Other functions. The liver manufactures various blood proteins, including *albumin, globulins,* and *fibrinogen.* Albumin helps to prevent *plasma* (the liquid portion of the blood) from seeping through the walls of the blood vessels. Globulins help the body fight infections. Fibrinogen enables the blood to seal broken blood vessels by forming a clot.

The liver also secretes *cholesterol,* a fatty substance. The body uses cholesterol to build cell membranes and to manufacture certain *hormones,* including the sex hormones. Hormones are chemicals that influence various body functions. Liver cells use cholesterol to manufacture bile salts.

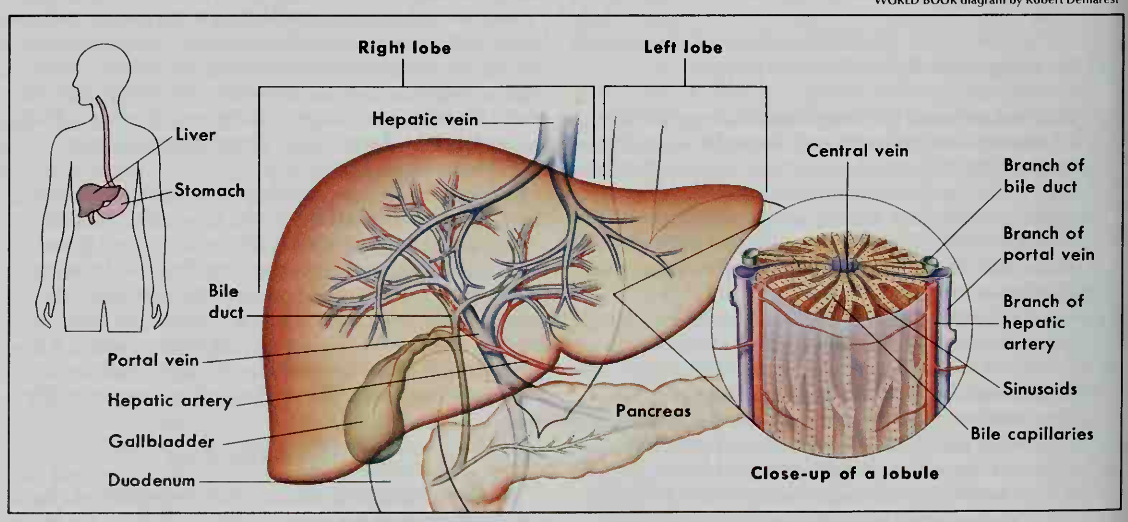
Diseases of the liver

Because the liver performs so many vital jobs, liver diseases can have serious consequences. Death occurs if the liver stops functioning. In some cases of advanced liver disease, physicians can remove the patient's damaged liver and replace it with a healthy liver from a deceased donor.

Most liver diseases are painless in their early stages and therefore are difficult to detect. In many cases, one of the earliest signs of liver disease is *jaundice.* Jaundice occurs when the blood contains an excessive amount of bilirubin. This excess bilirubin causes a yellowish discoloration of the skin and the whites of the eyes. Jaundice may result if diseased liver cells fail to remove bilirubin

The liver The liver consists of two main sections—the right lobe and the left lobe—and two small lobes that lie behind the right lobe. Each lobe is made up of hexagonal-shaped units called *lobules.* The close-up section of the diagram below shows an enlarged view of a lobule.

WORLD BOOK diagram by Robert Demarest



from the blood. Jaundice also may occur if gallstones block the common bile duct, thus preventing the excretion of bilirubin in the bile. See **Jaundice**.

Hepatitis is an inflammation of the liver. Hepatitis may be caused by viruses or by toxins. There are five main types of viral hepatitis: hepatitis A, B, C, D, and E. They are spread in different ways and have different characteristics. For example, hepatitis A usually spreads through food and water that have been contaminated by human or animal waste. Most cases do not result in serious illness. Hepatitis B is transmitted by close contact with an infected person, or by exposure to infected blood. Severe cases of hepatitis B can lead to liver failure and death. A vaccine that prevents hepatitis B is available, and public health experts in the United States recommend that all children be vaccinated against this disease.

Toxic hepatitis results from exposure to various chemicals. Such substances include carbon tetrachloride and other cleaning fluids, industrial chemicals, and certain medications. See **Hepatitis**.

Cirrhosis occurs when scar tissue replaces healthy liver cells. This process decreases the ability of the liver to perform its vital functions. Cirrhosis ranks as the sixth leading cause of death in the United States. However, not all cases of cirrhosis result in death. Alcoholism is the most common cause of cirrhosis. Hepatitis can also cause cirrhosis. See **Cirrhosis**.

Other liver diseases. Because the liver filters disease-causing microorganisms from the blood, it frequently becomes infected when diseases strike other parts of the body. Such diseases as tuberculosis, amebic dysentery, histoplasmosis, and syphilis—all of which begin elsewhere in the body—can eventually affect the liver. Cancers from other parts of the body also often spread to the liver. Charles S. Lieber

See also **Human body** (Trans-Vision); **Bile; Gallbladder; Glycogen.**

Liver spots. See **Skin** (Skin color).

Liverpool (pop. 448,300; met. area pop. 1,376,800) is a large commercial and manufacturing city in England. It lies on the River Mersey in western England, near the Irish Sea (see **England** [political map]).

The commercial center of Liverpool is one of the largest shopping districts in the United Kingdom. It borders the river and has several buildings that are city landmarks. They include the Royal Liver Building, which has twin towers. Each tower is topped by a sculpture of the *liver bird,* a mythical creature after which the city is said to have been named. Other famous buildings in the commercial center are the Town Hall, built in 1749, and St. George's Hall, which dates from 1842. St. George's Hall serves as a court building and public hall.

The inner city of Liverpool lies outside the commercial center. The inner city, which once made up a suburban area, has much old, run-down housing. However, this part of the city also includes Liverpool University, the Anglican Cathedral, and the Roman Catholic Metropolitan Cathedral. Suburbs are beyond the inner city.

The city's Walker Art Gallery owns one of the nation's finest collections of paintings outside London. Liverpool has an orchestra, several theaters, and two professional soccer teams. Many of Liverpool's people speak with a local accent called *Scouse.*



© G. Boutin, Explorer

Liverpool's landmarks include the Royal Liver Building, *above.* The building is famous for its twin towers, each of which is topped by a sculpture of the mythical liver bird. The city is said to have been named after the liver bird.

Liverpool became an important port city in the 1700's, during the Industrial Revolution. Its port has declined in importance since the 1960's. Shipping remains an important economic activity in the Liverpool area, but most of it takes place at nearby ports outside the city. Major industrial facilities of Liverpool include flour mills, sugar refineries, and an automobile-manufacturing plant.

Liverpool was founded in 1207 and began to flourish as a trade center in the 1700's. Ships based in Liverpool carried slaves from Africa to the West Indies and North America in exchange for various products. During the 1800's, trade activities in Liverpool increased sharply, and the city expanded rapidly. During World War II (1939-1945), German bombers heavily damaged the city and its docks. Since the war, the decline of the port, plus other factors, have contributed to a high rate of unemployment in the area. Anthony Sutcliffe

See also **Mersey, River.**

Liverwort is a type of small plant. There are about 8,000 species of liverworts, about 530 of which grow in the United States and Canada. Liverworts are found in polar, mild, and tropical regions. They contain chemicals called *terpenoids,* which give some liverworts a spicy aroma. Liverworts generally are inedible to people and many animals.

Botanists distinguish two general types of liverworts, *thalloid* and *leafy.* Thalloid liverworts consist only of a flat, leaflike *thallus* that grows horizontally along the ground. Leafy liverworts have three rows of leaves growing on a stem.

Liverworts do not have true roots. Instead, they are anchored to the ground by hairlike structures called *rhizoids.* A liverwort absorbs water over its entire surface and dries out quickly. Consequently, liverworts grow extremely close to the ground and often measure less than $\frac{1}{2}$ inch (1.4 centimeters) high. Most liverworts grow only


Oxford Scientific Films from Earth Scenes

Liverworts are small, leafy plants. They grow in damp, shady places, such as rotten logs and stream banks.

in damp, shady environments, such as rotten logs, stream banks, and moist cliffs.

The life cycle of liverworts involves two distinct forms of the plant, the *sporophyte* and the *gametophyte.* The sporophyte consists of a small stalk with a podlike capsule that releases microscopic cells called *spores* into the air. The liverwort life cycle begins when a windblown spore lands in a suitable, moist location and develops into a gametophyte. The gametophyte is the form of the plant familiarly recognized as the liverwort. Most liverwort gametophytes develop one of two types of reproductive structures—spherical *antheridia* or flasklike *archegonia.* In some species of liverworts, the gametophyte bears both antheridia and archegonia. Each antheridium releases *sperm* (male sex cells), and each archegonium contains an *egg* (female sex cell). A sperm may swim to an archegonium and fertilize the egg. The fertilized egg eventually develops into a sporophyte, completing the life cycle. Susan Moyle Studlar

Scientific classification. Liverworts make up the class Hepaticae. Liverworts, mosses, and hornworts make up the division Bryophyta.

See also **Bryophyte; Hornwort;** Moss; **Plant** (pictures: Bryophytes).

Livestock are domestic animals that are used to produce food and many other valuable products. The skins of some livestock provide such important materials as leather and wool. Various organs of livestock supply drugs used by countless people.

Farmers in developing nations use livestock to pull farm equipment and to transport people and materials. Most of the world's livestock are raised on farms and ranches. However, some people raise rabbits, chickens, or other small livestock in their yards.

The chief kinds of livestock raised throughout the world are cattle, hogs, poultry, sheep, and horses. Other kinds of livestock include donkeys, goats, mules, and rabbits. In some countries, farmers raise llamas, reindeer, water buffalo, and yaks. The science of raising, breeding, and caring for livestock is called *animal science.*

At one time, people wandered from place to place hunting animals and gathering plants for food. Several thousand years ago, people began to domesticate and raise various kinds of livestock. The use of domesticated animals as a source of food and power made it possible for people to settle in one place. They then could begin farming.

Through the centuries, farmers improved their livestock through various breeding methods. Today, many


Grant Heilman


John Colwell from Grant Heilman

Modern methods of raising livestock have increased production and efficiency. Many cattle receive special feed, *left,* that increases their growth rate. Some poultry houses, *right,* have equipment that automatically provides feed and water and collects eggs.



© Mathias Oppersdorff, Photo Researchers

Livestock serve as work animals on farms in some countries. This Indonesian farmer is using a team of oxen to pull a plow.

livestock raisers enter their animals in livestock shows. Judges rate the livestock on such points as their size and their yield of meat. In countries with advanced technology, many breeders use a computerized system that provides a genetic analysis of an animal's traits.

This article provides general information on livestock. See also the separate *World Book* articles on the animals discussed.

Uses of livestock

In most parts of the world, livestock provide such food products as meat, butter, cheese, eggs, and milk. These foods contain large amounts of protein, which builds new tissue and maintains and repairs old tissue in the human body. Animal food products also supply minerals and vitamins that people need for good health.

Livestock also provide such valuable by-products as fur, hair, leather, and wool. These materials are used to produce blankets, brushes, clothing, shoes, and other goods. Manufacturers use the hoofs and horns of livestock to make such articles as buttons, combs, glue, and knives. Other livestock by-products are used in the preparation of livestock feed.

Some of the glands and organs of certain livestock are used to make such drugs as epinephrine, insulin, and pepsin. Animal fat can be processed and made into livestock feed, shortening, and soap. Manufacturers use the feathers of ducks and geese in making bedding and insulated clothing.

Every year, livestock produce tons of body wastes that are used to fertilize the soil. This organic fertilizer increases the growth and food production of many plants.

Horses were once widely used as work animals on farms. But automated farm equipment has replaced horses for farm work in most parts of the world. Today, people in developed nations use horses primarily for recreational riding, and for racing and other sports.

Care of livestock

Feed. A domestic animal's daily food intake is called a *ration.* A balanced ration contains the *nutrients* (nourishing substances) that the animal needs for growth and good health. These nutrients include carbohydrates, fats, minerals, protein, and vitamins. Animals suffering from nutritional deficiencies produce less meat and milk, or fewer eggs. They may become unhealthy. Animal feed companies and many livestock producers use computers to determine the kind and proportion of ingredients used in livestock rations.

Swine and poultry feed consists of various grains, by-products from food processing, minerals, vitamins, and concentrated plant and animal proteins. Cattle, sheep, and other *ruminants* (animals with more than one stomach compartment) eat the grasses and *legumes* (plants in the pea family) of pastureland. They are also fed grain, hay, the stalks of certain plants, and other crop remains. The meat, milk, and eggs that livestock yield are more complete sources of protein than the plants they eat. Cattle that eat only grain can produce more milk, or beef that is more tender, than cattle fed a regular diet.

Many farmers raise beef cattle in fenced-in areas called *feedlots.* These animals receive grain and food-processing by-products that increase their growth rate. The use of feedlots decreases the amount of land needed for grazing. It also concentrates the amount of animal wastes available for use as fertilizer. Farmers use wastes from feedlots to fertilize their crops.

Drugs called *additives* are blended with some feeds to increase the animal's growth rate, reduce the amount of food required for growth, and lessen the chance of disease. These additives include antibiotics and synthetic hormones. In many countries, the government controls the dosage and use of certain additives that might harm animal or human life.

Shelter. Livestock require protection from severe weather so they can maintain satisfactory growth and reproduction. Before domestication, these animals could more easily live without shelter. Through the years, farmers have developed breeding methods designed to increase meat production. But livestock have become less hardy as a result.

Livestock owners provide the most economical type of shelter that can best maintain the animals' health and levels of food production. Some livestock need only a windbreak or a shade tree for shelter. Others live in climate-controlled buildings where the humidity, light, sound level, temperature, and ventilation are precisely regulated.

Livestock raised in climate-controlled buildings are usually confined in small groups to reduce competition and fighting. The buildings are designed so that the animal waste falls through cracks into pits below the floor. This design allows the animals to stay dry and clean. The waste is pumped from the pits and carried to the fields, where it is used as fertilizer.

Prevention of disease ranks as a major concern of livestock raisers. Some diseases can kill large numbers of livestock or be transmitted to people. On rare occasions, to prevent an epidemic, farmers may have to destroy all livestock that have come in contact with infected animals.

The chief causes of livestock diseases include bacteria, fungi, parasites, and viruses. Livestock also can become ill if they consume natural poisons or insecticides and certain other chemicals sprayed on grass and plants. Livestock inherit sensitivity to some diseases.

Many disease-carrying organisms that infect livestock are found in warm climates. Foot-and-mouth disease, tick fever, and other diseases severely limit livestock production in tropical countries.

Diseases tend to spread more rapidly among hogs, poultry, and other livestock that are kept in confined areas. Young animals also tend to become infected easily.

Scientists conduct many research programs to find new ways of combating livestock diseases. These experts work to identify and eliminate the organisms that spread such diseases as salmonella and tuberculosis. Identification of specific genes that produce resistance to diseases can also lead to healthier animals.

Breeding livestock

Livestock raisers select certain animals for reproduction. Such livestock may be chosen because they have a high rate of growth or produce large amounts of meat, eggs, or milk. This practice, called *selective breeding,* allows farmers to continually improve their livestock. Livestock raisers select only healthy, fertile animals for breeding. There are three chief methods of selective breeding. They are (1) selective mating, (2) inbreeding, and (3) outbreeding.

Selective mating is the simplest type of livestock breeding. Livestock producers place selected males and females of one species in the same area and allow them to mate. Most commonly, breeders allow only certain females to mate with certain males so that they know the parentage of the offspring. This procedure helps breeders to identify animals that carry desirable genetic traits.

Inbreeding. Farmers practice inbreeding by mating animals that are closely related to each other. Livestock producers select animals for inbreeding by studying their *pedigrees,* which list an animal's ancestors. Livestock that are closely related have similar genes, which are transmitted to their offspring. Inbreeding thus produces highly uniform offspring. These offspring may have a high concentration of the parents' favorable genes. However, inferior genes that were not visible in the parents may show up strongly in the young. Therefore, inbreeding may produce a small animal or one that lacks resistance to disease. Inbreeding is practiced only among a few select purebred animals.

Outbreeding is the mating of unrelated animals. *Outcrossing* and *crossbreeding* are two methods of outbreeding often used by farmers. Outcrossing is the mating of unrelated animals of the same breed. This method is used by breeders of purebred animals to reduce the chances of undesirable effects of inbreeding. Crossbreeding is the mating of animals of different breeds. Most offspring have a higher performance level than the average performance of the parents. Almost all breeders of nonpurebreds use this breeding method.

Many breeders use artificial insemination to improve the quality of their livestock. The breeders inject diluted *semen* (sperm-carrying fluid) from a high-quality male into the reproductive tract of the female at the proper time for fertilization. Artificial insemination increases the number of offspring that superior male animals can produce.

Marketing livestock

At one time, farmers brought each type of livestock to market during a certain season. They regulated the rations of the animals to have them ready for sale at a certain time. Today, many livestock producers market animals throughout the year to ensure a steady supply of products and to better regulate pricing.

In the United States, the Department of Agriculture supervises the operations of markets that handle livestock shipped across state borders. The department regulates the fees charged by these markets and prevents unfair and fraudulent trade practices.

Livestock prices are determined in the various markets where the animals are sold. There are three kinds of livestock markets: (1) auction markets, (2) terminal markets, and (3) direct markets.

Auction markets enable livestock buyers to bid openly. The auctioneer usually starts the bidding at a reasonable price. The animals are sold to the buyer who offers the highest price. If many buyers bid for a certain kind of livestock, the producer usually receives a high price. If few bid, the price tends to be lower.

Terminal markets are large markets near a big city. At one time, all trades made at terminals were private. Terminal markets also operate auctions. Professional market experts help livestock producers sell their animals and receive a commission from the producer for doing so. Because of the cost of the commission and the transportation of animals to a terminal market, producers sell fewer animals this way.

Direct markets. Sales at direct markets are made between the producer and buyer without the help of a professional agent. Thus, the producer does not have to pay a commission to sell stock. Many meat-packing companies have established buying stations that serve as direct markets. Many livestock producers enter into *forward contracts* with processors. Such agreements ensure producers a reasonable price for their stock months before the animals are sold. In some countries, livestock producers also practice *hedging* through various commodity exchanges. Hedging reduces risks by locking in a price for a future sale date. John Carlson

Related articles in *World Book* include:

Chief kinds of livestock

Cattle	Poultry
Chicken	Rabbit
Duck	Sheep
Hog	Turkey
Horse	

Other related articles

Agriculture
Breeding
Dairying (Dairy farms)
Farm and farming (with pictures)
Feed
Foot-and-mouth disease
Meat packing
Veterinary medicine

Living standard. See Standard of living.

Living will is a document that states the kind of medical care an individual would prefer if, due to injury or disease, the person could not communicate his or her wishes. It also may name treatments the person would not want. Such treatments include restarting the heart, and feeding—by artificial means—patients who can no longer eat normally. Living wills may come into force

when patients are near death or in a coma from which they can never recover. Living wills are useful because, unless told otherwise, many physicians assume their patients want to be kept alive as long as possible.

To be legally valid in the United States, a living will must be written, signed, and witnessed in a manner determined by state law. The document is called a *living will* because, unlike a regular will, it becomes effective while the person is still alive. David C. Thomasma

See also **Medical ethics**.

Livingston, Philip (1716-1778), an American statesman, was a New York signer of the Declaration of Independence in 1776. He gave much of his fortune to help the patriots in the Revolutionary War in America (1775-1783). As an importer in New York City, Livingston was active in public affairs. He was a delegate to the Stamp Act Congress in 1765, to the Continental Congress from 1774 to 1778, and to the New York Provincial Congress in 1777. Livingston was born in Albany, New York, and graduated from Yale University. Jack N. Rakove

Livingston, Robert R. (1746-1813), an American statesman, helped write the Declaration of Independence in 1776. He was a member of the New York convention that ratified the United States Constitution in 1788, and he helped draft the New York state Constitution of 1777. In 1789, he administered the oath of office to the first U.S. President, George Washington.

Livingston was born in New York City and studied at King's College, now Columbia University. In 1775 and 1776, Livingston served as a New York delegate to the Continental Congress. From 1777 to 1801, he was chancellor, or presiding judge, of the New York court of chancery. Livingston served as the first U.S. secretary of foreign affairs from 1781 to 1783. He was also U.S. minister to France from 1801 to 1804. While in France, he negotiated the Louisiana Purchase, which added a vast new territory to the United States. Later, Livingston gave the American inventor Robert Fulton help in building the *Clermont,* Fulton's famous steamboat. In 1875, the state of New York placed a statue of Livingston in the U.S. Capitol in Washington, D.C. Jack N. Rakove

See also **Jefferson, Thomas** (The Louisiana Purchase).

Livingston, William (1723-1790), was a New Jersey signer of the Constitution of the United States. He was the senior New Jersey delegate at the 1787 Constitutional Convention in Philadelphia and became known for his ability to help delegates work out compromises. Livingston served as chairman of the committee that created regulations for the slave trade and set up guidelines for direct taxation. He also led a committee that worked on such matters as the states' militia and federal payment of states' debts. Livingston later helped win swift and unanimous *ratification* (approval) of the Constitution by New Jersey.

Livingston was born in Albany, New York. He graduated from Yale College in 1741 and practiced law in New York City. In the 1760's, Livingston became a prominent opponent of British policy. He moved to New Jersey in 1772 and later represented the colony in the First and Second Continental Congresses. Livingston took command of the New Jersey militia in June 1776. Two months later, he was chosen the first governor of the state of New Jersey. He retained this position for the rest of his life. Richard D. Brown

Livingstone, David. See **Stanley and Livingstone**.

Livy, *LIHV ee* (59 B.C.-A.D. 17), was one of the greatest Roman historians. His *Historiae ab Urbe Condita* (*History from the Founding of the City*) tells of Roman history from the founding of Rome until the death of Drusus in 9 B.C. The work is also a valuable source of information about the social, cultural, and political attitudes of many Romans during the reign of Emperor Augustus (27 B.C.-A.D. 14). Livy wrote the work in 142 books, but only 35 of them are still in existence.

Livy spent more than 40 years working on his history, which became famous in ancient times and was widely quoted. The lengthy work became known chiefly through short summaries or abridgments. Many of these summaries have survived.

Livy was born in Padua in northern Italy and lived in Rome during the reign of Emperor Augustus. He was a friend of the emperor, but he carefully guarded his independence as a historian. D. Brendan Nagle

Lizard is a reptile closely related to snakes. Like snakes, some lizards are legless. Others resemble snakes but have legs. Many large lizards look much like crocodiles. Lizards vary in size, shape, and color. They have many different ways of moving about and of defending themselves. Scientists have identified almost 3,800 different species of lizards.

In parts of the United States, many people mistake lizards for salamanders. The salamanders are commonly called "spring lizards" or "wood lizards." Salamanders and lizards look much alike, but they are not related. Both are cold-blooded animals. These animals cannot keep their bodies much warmer or cooler than their surroundings. But lizards have dry, scaly skin and clawed toes. Salamanders are amphibians related to frogs, and have moist skin and no scales or claws. Lizards love to stay in the sun, but salamanders usually avoid sunlight. See **Cold-blooded animal; Salamander**.

Where lizards live. Lizards lack the built-in body temperature control many other animals have. So, most lizards live in places where the ground never freezes. Those that live in areas with cold winters must hibernate. Lizards thrive in the tropics and warm parts of the temperate zones. They are the most common reptiles found in deserts and other dry regions. When the desert becomes too hot for comfort, lizards lie in the shade or under the sand to escape the sun's rays.

Sizes of lizards. The smallest lizards are only a few inches or centimeters in length. The largest lizard is the *Komodo dragon.* This huge East Indian lizard grows about 9 to 10 feet (2.7 to 3 meters) long and may weigh nearly 300 pounds (140 kilograms). The Komodo dragon belongs to a group of lizards known as *monitors.* Some other monitors grow to be 6 to 7 feet (1.8 to 2.1 meters) in length. These lizards live in Africa, India, and Australia.

How lizards move. The most remarkable thing about lizards is the variety of ways by which they move. More than 65 million years ago, huge lizards called *mosasaurs* swam in the sea. Even today, giant monitors sometimes swim from one island to another. No present-day lizard can fly, but a small group in Asia and the East Indies glide from tree to tree like flying squirrels. These lizards are the so-called *flying dragons.* They can spread out a fold of skin along either side of their body



Bob Campbell, Bruce Coleman Ltd.

The Nile monitor of Africa grows more than 6 feet (1.8 meters) long. It digs, runs, and swims well, and can climb trees. This lizard spends much time in water and feeds on many kinds of smaller animals.

by moving several long ribs. This extended fold of skin forms a sort of sail that is used to glide through the air.

Most lizards, however, live on the ground or in trees. Even on the ground, the lizards have many different ways of moving about. Many people in the United States know the swift little lizards that scamper over old fences and logs. Some *geckos,* lizards that spend much time in trees, have claws that they can draw in as a cat does. Some have slits on their toes that function like suction disks. The claws catch in rough surfaces such as bark, and the slits cling to smoother ones. A gecko can walk upside down across a plaster ceiling without trouble, and can even cling to a pane of glass. The Australian *fringed lizard* and the *basilisk* of tropical America can run by raising the front of the body and running on their hind legs.

Many lizards that live on the ground can get along without any legs. Some *skinks,* for example, have no legs. Other skinks have weak, nearly useless legs. The *glass snake* of the Eastern United States is really a lizard without legs. It has well-developed eyelids and ear openings, both of which are absent in snakes.

Defenses. Lizards defend themselves in a great variety of ways. Like some snakes, many lizards bluff or play tricks. The glass snake has one of the most unusual methods of defense. This lizard's tail is twice as long as its body, and as brittle as an old twig. If an enemy seizes the lizard's tail, the animal simply breaks off its tail and crawls to safety. Meanwhile, the tail keeps wriggling as though it were alive, fooling the enemy that struggles with it. The lizard does not seem to miss its tail, and in due time it grows a new, shorter one. Several other kinds of lizards, including skinks, can break off their tails and grow new ones to replace them.

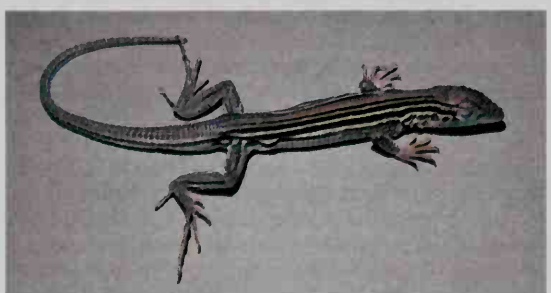
Other common ways of bluffing include swelling up, hissing, and lashing the tail. The Australian *frilled lizard* ranks as one of the best bluffers. This lizard rears on its hind legs, spreads an enormous frill out on each side of its neck, opens its mouth, and hisses. These antics make the frilled lizard look several times as big and fierce as it really is. A large frilled lizard measures about 32 inches (81 centimeters) long.

Some lizards are not such harmless fighters. The monitors and their relatives use their large jaws for biting. They also use their tails as whips to strike a sharp blow. Unlike snakes, few lizards are poisonous. The only poisonous lizards are the *Gila monster* of the Southwestern United States and northern Mexico, and its close relative, the *beaded lizard* of Mexico.

The *horned lizards* have an unusual ability. They can squirt a thin stream of blood from their eyes for a distance of 3 feet (0.9 meter). They use this trick when an enemy attacks them. Sharp spines on their head and back provide added protection. Many people call these lizards *horned toads* because their body has a flattened, toadlike shape.

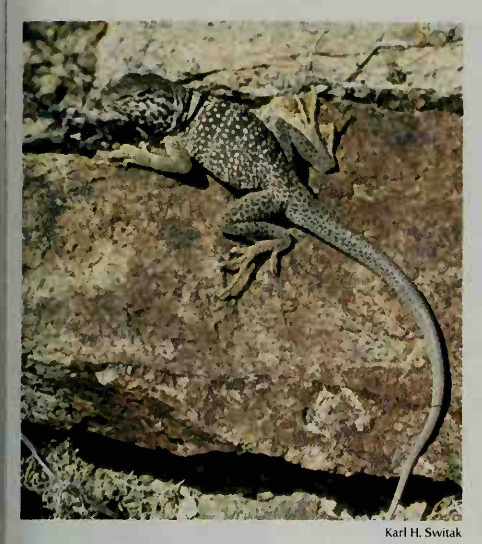
The *African chameleons* are famous for the way they can change color. Many other lizards have the same power. Many persons think that these changes help the animal to protect itself, but they are not always used in this way. Sometimes, these lizards turn a darker color to absorb more heat from the sun's rays. Some lizards do rely on their colors for protection. Many desert lizards are light in hue, and those that dwell in the forest are darker. The different species have various combinations of green, red, gray, brown, white, and black.

Reproduction. Most lizards lay eggs. Some deposit them in simple nests. The female skink may coil around the eggs and drive away any intruders. If the eggs become scattered, she brings them back together.



Joseph Collins, University of Kansas

The six-lined race runner of the Southeastern United States can run as fast as 18 miles (29 kilometers) per hour. It escapes its enemies by darting into a hole or under rocks.



Karl H. Switak

The collared lizard is named for the black bands around its neck. It lives mainly in rocky areas of the southwestern United States.



Warren Garst, Tom Stack & Assoc.

The Australian frilled lizard frightens enemies away by opening its mouth with a hiss and unfolding the large frill that encircles its head. The frill of an adult male may have a diameter of 9 inches (23 centimeters).

Some lizards do not lay their eggs but give birth to living young after the eggs hatch in the lizard's body. Others reproduce in somewhat the same way as mammals. These lizards also give birth to living young. Before birth, the developing lizard gets food from the mother's body. Unlike female mammals, the female lizard does not nurse her young or care for them after birth.

Some species of North American *whiptails* and European *lacertid lizards* have only female individuals. The adult females lay unfertilized eggs that hatch only into females.

Food. Lizards have less interesting eating habits than snakes. But, unlike snakes, some eat plants instead of animals. The *marine iguanas* of the Galapagos Islands feed on algae, which they gather off the rocks at low tide. Hundreds of species of lizards eat mostly insects and small animals. Most do not limit their diet to any one thing. A few lizards, such as African chameleons, have a tongue that they can shoot out beyond their snout. They capture insects on their tongue's mucus-coated tip. Other lizards seize their victims in their mouths. They swallow their prey as soon as it stops struggling.

Dangers to lizards. Human activities threaten the survival of certain species of lizards. People gather lizard eggs and hunt iguanas and other lizards for food in some countries. In many areas, the animal's habitats have been destroyed. In the past, some lizards were killed for their skins, which were used to make wallets, handbags, and other products. But many countries now forbid killing lizards for this purpose. Carl H. Ernst

Scientific classification. Lizards belong to the class Reptilia. They are members of the order Squamata, along with snakes. Lizards alone make up the suborder Lacertilia (sometimes called Sauria).

Related articles in *World Book* include:

Animal (picture: Animals of the tropical forests)
Anole
Blindworm
Brain (picture: Brains of some vertebrates)
Chameleon
Chuckwalla
Flying dragon
Gecko
Gila monster
Glass lizard
Horned lizard
Iguana
Komodo dragon
Monitor
Prehistoric animal
Reptile
Skink
Swift

Ljubljana, *LYOO blee YAH nuh* (pop. 276,133), is the capital and largest city of Slovenia. It is located in the central part of the country (see **Slovenia** [map]).

Ljubljana is the cultural center of Slovenia. It is the home of the University of Ljubljana and several museums. The museums include the National Museum, the Slovenian Natural History Museum, and the Ethnographic Museum. The chief products manufactured in Ljubljana include electronics, machinery, paper products, and textiles.

The first settlements in the Ljubljana area date from about 3000 B.C. Ljubljana was under Austrian control during most of the period from A.D. 1276 to 1918. The city had become an important wine-producing center by the 1700's. In 1918, it was made capital of Slovenia, a part of a country called the Kingdom of the Serbs, Croats, and Slovenes. This country was renamed Yugoslavia in 1929. Slovenia declared independence from Yugoslavia in 1991, and Ljubljana became capital of the new country. Sabrina P. Ramet

Llama, *LAH muh,* is the largest South American member of the camel family. The llama, like its smaller relative, the *alpaca,* is a domesticated animal that may be descended from the *guanaco.* The *vicuña* is the llama's only other wild relative.

The llama has no hump and is about 4 feet (1.2 meters) tall at the shoulder. Its thick, long hair may be brown, buff, gray, white, or black. The female llama bears one young at a time.

The llama is most useful as a pack animal. Llamas generally can carry about 130 pounds (60 kilograms) each and are sure-footed on the mountain trails. They can travel from 15 to 20 miles (24 to 32 kilometers) a day with a full load. If a llama feels its pack is too heavy, or if it thinks it has worked hard enough, it will lie down and



Jerry Cooke, Animals Animals

The llama has thick hair and a long neck and looks somewhat like a small camel. But unlike camels, llamas have no hump.

refuse to move. When the llama is angry or under attack, it spits bad-smelling saliva in its enemy's face.

The llama is useful to the Indians of the South American Andes. When the Spanish conquerors came to this area during the 1500's, about 300,000 llamas were being used to carry silver from the mines. The Indians still use llamas to transport goods. They eat the meat of the young animals. They use the hair of the llama to make garments, and they use its hide to make sandals. In the United States and Canada, sometimes llamas are used as pack animals and are raised for their wool.

The llama is inexpensive to keep. It is hardy and eats grasses and low shrubs that grow on high mountains. The llama does not need to drink much water. It can get much of its moisture from plants. Anne Innis Dagg

Scientific classification. Llamas are members of the camel family, Camelidae. They are *Lama glama.*

See also **Alpaca; Camel; Guanaco; Ruminant; Vicuña.**

Llanfairpwllgwyngyll, *THLAN vyr poothl GWIHN gihthl,* is a village in northwestern Wales. As a hoax, in the early 1800's, the village's name was lengthened to *Llanfairpwllgwyngyllgogerychwyrndrobwllllantysilio-gogogoch.* It was the longest place name in Britain. In 1988, the village council officially returned to the shorter name. For location, see **Wales** (map).

The word *Llan* means *church* in Welsh. *Fair,* which was originally spelled *Mair,* is the name for the Virgin Mary. *Pwllgwyngyll,* which means *hollow of white hazel,* was the name of the medieval township in which the church of the name *Llanfair* was located. The long name means *Church of St. Mary in a hollow of white hazel, near a rapid whirlpool, and St. Tysilio's Church of the red cave.* D. Q. Bowen

Llanos, *LAH nohz* or *YAH nohz,* meaning *level lands,* is most often used to mean a great *savanna* (grassland with scattered trees) region in Venezuela and Colombia. This plain is known as the Orinoco Basin. The region covers about 300,000 square miles (780,000 square kilometers). Farmers have traditionally raised cattle and horses on the llanos. However, the region has wet and dry seasons that make farming difficult.

During the 1960's, government officials began flood control and irrigation programs to increase agricultural production on the llanos. A major industrial facility is located at Ciudad Guayana, Venezuela, on the llanos. The facility uses iron ore and bauxite from nearby mines. It receives energy from a hydroelectric plant on the Orinoco River. Jerry R. Williams

See also **Pampa; Savanna.**

Lloyd, Harold Clayton (1894-1971), was a comedian who won fame in silent motion pictures. He created and acted the role of "Harold." The character was a small-town boy who overcomes comic adversity to achieve success and impress his girlfriend in the big-city business world of the 1920's. Lloyd made a specialty of adventures on tall buildings. He appeared in a famous scene hanging from a clock atop an office building in *Safety Last* (1923). Lloyd's other silent comedy features include *Grandma's Boy* (1922), *The Freshman* (1925), and *The Kid Brother* (1927). Lloyd also made several sound comedies.



Pictorial Parade

Harold Lloyd

Lloyd was born in Burchard, Nebraska. He began his screen acting career in 1915. Robert Sklar

Lloyd, Henry Demarest, *DEHM uh rehst* (1847-1903), an American writer, won fame for revealing unfair business practices in the United States during the late 1800's. He criticized the idea that what was good for business was also good for society, and preached that many corporations put their interests ahead of those of the worker, the public, and the government. Lloyd's exposures introduced a type of probing writing that became known as *muckraking* (see **Muckrakers**).

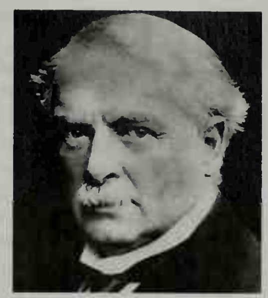
Lloyd was born in New York City. In 1881, he wrote a magazine article accusing Standard Oil Company of receiving lower rates and *rebates* (returned money) from the railroads. He expanded his attack on big business in his best-known book, *Wealth Against Commonwealth* (1894). Charles B. Forcey and Linda R. Forcey

Lloyd George, David (1863-1945), a British Liberal Party leader, served as prime minister during the last half of World War I (1914-1918). He was also prominent in helping to draft the Treaty of Versailles. He led the British delegation at the conference which drew up the treaty that ended World War I. Lloyd George was active in British politics until his death.

Early career. Lloyd George was born of Welsh parents in Manchester, England. His father died when he was a year old. His mother took him to Llanystumdwy in Caernarvonshire (now Gwynedd), Wales. There he grew up in the home of his uncle, Richard Lloyd, a shoemaker and a Baptist minister. He was reared in an atmosphere of hostility to the landed aristocracy and the Church of England. He was apprenticed to a law firm at 16 and began to practice law at 21.

Lloyd George early associated himself with the Lib-

eral Party. In 1890, on a platform of social reform for Wales, he was elected to Parliament for the Caernarvon Boroughs. He represented this constituency continuously for 55 years. He soon established a reputation as a "radical" and became known through his attacks on the government's policy in South Africa before and during the Boer War (1899-1902).



United Press Int.
David Lloyd George

When the Liberals returned to power in 1905, Lloyd George became president of the Board of Trade. From 1908 to 1915, he served as chancellor of the exchequer. He sponsored the Old Age Pension Act of 1908 and the National Insurance Act of 1911. His "People's Budget" of 1909 introduced a tax on "unearned income" and greatly increased land and inheritance taxes. The Conservative House of Lords rejected this budget. This rejection caused a constitutional crisis with the House of Commons that ended in victory for Lloyd George and his party. The power to veto financial legislation was taken away from the House of Lords.

Prime minister. The coming of war in 1914 changed Lloyd George from a pacifist to a staunch supporter of the war against Germany. As minister of munitions in 1915, he ended shortages in ammunition. In July 1916, he succeeded Lord Kitchener as secretary of war, and in December 1916, he replaced Herbert Asquith as prime minister. Lloyd George is generally recognized as one of the United Kingdom's great war leaders. His leadership strengthened civilian morale. At the Paris Peace Conference in 1919, he mediated successfully between the idealism of President Woodrow Wilson and the severe peace terms sought by Premier Georges Clemenceau of France.

An easy electoral victory in December 1918 kept Lloyd George and his coalition government in office. But he did not achieve the economic reconstruction he had promised. His Irish policy led to the formation of the Irish Free State but cost him Conservative support. His pro-Greek policy failed. He resigned in 1922.

The Liberal Party, divided in 1918 between supporters of Lloyd George and Asquith, was reunited in 1923 but could not regain popular support. It soon became a weak third party after a disastrous election in 1924.

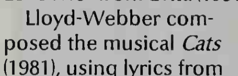
Lloyd George tried unsuccessfully to make a comeback with an elaborate program of public works and agricultural reform. He visited Adolf Hitler at Berchtesgaden in 1936 and returned with praise for the German leader. But he soon became a severe critic of appeasement of Hitler. In 1945, shortly before his death, he was created Earl of Dwyfor. Chris Cook

Lloyd-Webber, Andrew (1948-), is the most popular composer of his time in English music theater. He is especially known for his long, flowing melodic scores.

Lloyd-Webber first earned fame for his collaborations with English lyric writer Tim Rice on three musicals. These shows were *Jesus Christ Superstar* (1971), with its popular title song and "I Don't Know How to Love Him"; *Joseph and the Amazing Technicolor Dreamcoat* (1968, revised 1973 and 1991); and *Evita* (1978), with its hit song "Don't Cry for Me, Argentina." All three musicals originated as recordings. Lloyd-Webber and Rice also won the 1997 Academy Award for best song for "You Must Love Me" from *Evita* (1996).



AP/Wide World
Andrew Lloyd-Webber



Lloyd-Webber composed the musical *Cats* (1981), using lyrics from *Old Possum's Book of Practical Cats* (1939) by the poet T. S. Eliot. The musical's best-known song is "Memory." *The Phantom of the Opera* (1986) is based on a horror novel written by the French author Gaston Leroux.

Lloyd-Webber's other musicals include *Song and Dance* (1982), *Starlight Express* (1984), *Aspects of Love* (1989), *Sunset Boulevard* (1993), and *The Beautiful Game* (2000). He also composed *Requiem* (1985), a memorial Mass for his father. Lloyd-Webber was born on March 22, 1948, in London. He was knighted in 1992. In 1997, he was named a lord, taking the name Baron Andrew Lloyd-Webber of Sydmonton. Gerald Bordman

Lloyd's is an insurance society that was originally known as *Lloyd's of London.* It consists of individual members known as *Lloyd's underwriters.* The society is famous for insuring almost any risk. Lloyd's pioneered many forms of insurance that have since become commonplace, such as burglary, loss of profits, hurricane, and earthquake insurance. The society does not sell life insurance, except on a short-term basis.

Lloyd's underwriters are grouped into *syndicates* (combinations) that vary in size from a few people to several hundred people. Lloyd's provides its members with worldwide merchant shipping reports. This information is published daily in *Lloyd's List and Shipping Gazette.* Founded in 1734, it is the oldest newspaper in London.

Lloyd's originated in the coffee house of Edward Lloyd about 1690. The coffee house was a favorite meeting place for ship owners and wealthy merchants who would *underwrite* (accept the risk of) a marine insurance policy. Lloyd's partly or completely insured property lost in the San Francisco earthquake and fire in 1906, the sinking of the *Titanic* in 1912, the airship *Hindenburg,* which burned in 1937, and many hurricanes in the United States. Dan R. Anderson

See also **Insurance** (History); **Underwriting.**

Loach is any of about 175 species of small, slender, freshwater fish. Loaches live in mountain streams, lakes, and swamps in Europe, Asia, and Africa. Many loaches are flat on the underside, which allows them to lie on the bottom of fast-moving streams. Others have a rounder, more wormlike body. The mouth is on the underside of the head and is surrounded by 3 to 6 pairs of fleshy whiskers called *barbels.*

Most loaches are about 4 to 6 inches (10 to 15 centimeters) long. However, a species of loach called the European *weatherfish* can reach more than 18 inches (46 centimeters) in length. The weatherfish seems to become nervous and is much more active just before a

thunderstorm. Scientists think the fish acts this way because it can sense the change in atmospheric pressure that precedes a storm. Some loaches, such as the *clown loach,* are colorful and popular aquarium fishes. Many loaches are delicious to eat. John E. McCosker

Scientific classification. Loaches belong to the family Cobitidae. The scientific name for the weatherfish is *Misgurnus fossilis.*

See **Fish** (Fish of tropical fresh waters [picture]).

Loadstone. See **Lodestone.**

Loam is a soil that is between sandy soil and clay soil in texture. Loams are chiefly mixtures of sand, clay, and silt. They are among the most valuable soils in agriculture and are easy to till. A typical loam soil feels smooth and is somewhat sticky. A piece of clay feels very smooth and sticky. Soil between loam and clay in texture is called a *clay loam.* Soil between sand and loam is called *sandy loam. Silt loam* contains much silt. See also **Clay; Humus; Sand; Soil.** Taylor J. Johnston

Loan. See **Bank** (Making loans); **Bond; Insurance** (Life insurance); **Loan company.**

Loan company is an organization that lends money to individuals. Loan companies were organized chiefly to combat *loan sharks* (moneylenders who charge an illegal or high rate of interest). The personal finance company has been the most common type of successful small-loan company. It has taken much business away from the loan sharks.

The personal finance company is founded upon the Uniform Small Loan Law. This law was devised by the Russell Sage Foundation in 1916 and has since been adopted by many states. The basic law entitled companies to lend money in small sums, with or without security, and set maximum interest rates. Loan companies are licensed and supervised by state banking authorities. The law has been modified by some states to allow companies to make loans as high as $15,000 and to make second mortgages.

Many loan companies require only that the borrower's note be endorsed by two other acceptable parties. But most loans are usually made to individuals on the individual's signature. No comakers or endorsers are necessary. A chattel mortgage on the household goods or an assignment on wages is the most common security. Usually the loan is repaid in installments.

Today, loan companies face severe competition from credit card companies. Credit cards provide users with access to small loans for purchases with greater speed and ease than do loan companies. Credit card interest rates also are usually lower than those charged by loan companies. Carol S. Greenwald

Related articles in *World Book* include:

Assignment	Interest	Savings and loan association
Credit	Mortgage	Usury
Credit card	Pawnbroker	
Finance company		

Lobbying is an attempt to influence the decisions of government officials. People who try to persuade legislators to vote in a particular way are known as *lobbyists.* The words refer to the lobby or anteroom outside the room where legislators vote on public bills. Lobbyists also frequently try to influence the decisions of officials in the executive branch. The lobbyist may belong to a group interested in a particular law or be a paid agent of a group that wants certain bills passed or defeated.

Properly used, lobbying can serve a useful purpose. It may be the best organized way in which groups can make their wishes known to legislators. Much government policymaking involves a two-way flow of information between private groups and public officials. But not all lobbying is conducted along these lines. Sometimes the lobbyist may try to persuade a legislator or other government official by offering favors or money. At this point, lobbying becomes bribery (see **Bribery**).

Federal and state laws seek to prevent corruption in lobbying. The basic idea of these laws is to make lobbying practices public so that corrupt influences will be uncovered. Federal laws require individuals and groups trying to influence legislation to register. They must report the bills in which they are interested, the groups for which they lobby, the house of Congress or federal agency that they lobby, and their own receipts and expenditures.

Some constitutional questions may arise whenever laws limit or otherwise regulate lobbying. Such questions arise because the Constitution guarantees citizens the right of free speech and the right to petition legislators. Charles O. Jones

See also **Propaganda** (Organizations).

Additional resources

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Ness, Immanuel. *Encyclopedia of Interest Groups and Lobbyists in the United States.* Sharpe, 2000.

Lobel, *LOH behl,* **Arnold** (1933-1987), was an American illustrator and writer of books for young children. He became known for his sensitive and humorous animal stories. Lobel won the 1981 Caldecott Medal for his illustrations for *Fables* (1980), a book of animal tales he wrote. He dealt with friendship in several humorous books he wrote and illustrated, including *Frog and Toad Are Friends* (1970), *Mouse Tales* (1972), and *Owl at Home* (1975), as well as in the alphabet book *On Market Street* (1981), illustrated by his wife, Anita Lobel.

Lobel also illustrated about 40 books by other authors. Among these books are *The Comic Adventures of Old Mother Hubbard and Her Dog* (1968), *Sam the Minuteman* (1969), *Hildilid's Night* (1971), *The Clay Pot Boy* (1973), *As I Was Crossing Boston Common* (1973), *Merry, Merry FIBruary* (1977), and *The Random House Book of Mother Goose* (1986).

Lobel was born in Los Angeles. His first book was *A Zoo for Mister Muster* (1962). Nancy Lyman Huse

See also **Literature for children** (picture: Great illustrators of the 1900's).

Lobelia, *loh BEEL yuh,* is the name of a large *genus* (group) of plants that vary in form from small herbs to trees. There are more than 350 species of lobelias. The plants produce a milky juice, and most species have showy, two-lipped flowers.

Most species of lobelias grow in the tropics. The leaves and bark of the tree lobelias of Africa are eaten by gorillas, which also make nests in the tops of the trees. About 30 species of lobelias grow in the United States. Several of these are cultivated as garden flowers. They include the *great lobelia,* the *cardinal flower,* and the *edging lobelia.* North American Indians used the

dried leaves and blossoms of a lobelia called *Indian tobacco* in their medicine.

Scientific classification. Lobelias belong to the lobelia family, Lobeliaceae. George Yatskievych

See also **Cardinal flower.**

Loblolly. See **Pine** (Southeastern pines; picture).

Lobster is the name of a number of animals that live on the bottom of the ocean. They are *crustaceans,* hard-shelled animals with segmented bodies and jointed legs. People around the world prize lobsters for their tasty white meat. Great quantities of these animals are harvested from the Atlantic Ocean and Pacific Ocean each year.

This article will focus on the *American lobster.* The American lobster is commercially important for the delicious meat in its claws and tail. This species belongs to a group of lobsters known as *clawed lobsters.* There are several other lobster groups. *Spiny lobsters* get their name from the sharp spines on their shells. These lobsters are also important as seafood. They lack claws and their large tail contains much meat. *Slipper lobsters,* named for their flattened shape, are found mostly in warm waters. *Deep-sea lobsters* live buried in the ocean bottom at great depths. Most are blind.



Alex Kerstitch, Black Star

A spiny lobster, *above,* has slender legs and no claws. This kind of lobster was named for the sharp spines on its shell. Spiny lobsters live in coastal waters throughout warm regions.



George H. Harrison, Bruce Coleman Inc.

An American lobster, *above,* has thick legs and huge front claws. It uses its claws to kill and handle prey. Lobsters eat crabs, snails, small fish, and other lobsters.

The American lobster

Body. American lobsters are the largest species of lobster. They can measure as long as 42 inches (107 centimeters) and weigh nearly 45 pounds (20 kilograms). However, most lobsters are caught before they reach full size. Captured lobsters generally measure about 8 inches (30 centimeters) long and weigh only about 1 pound (0.45 kilogram) or less.

Like other crustaceans, American lobsters are *invertebrates*—that is, they lack a backbone. A strong shell called an *exoskeleton* protects the lobster's soft body parts. The shell is usually brownish-green with spots. Lobster shells turn bright red-orange when boiled.

The American lobster's body has 21 segments. The head has 6 segments; the *thorax*—the center part—has 8; and the *abdomen*—the tail part—has 7. Where the segments meet, the exoskeleton is thinner, so the lobster can bend its body and move. A lobster breathes through gills beneath the shell on both sides of its thorax.

An American lobster has two pairs of antennae on its head. The animal's eyes are on the ends of a pair of slender, jointed organs called *stalks.* Lobsters have *compound* eyes that consist of hundreds of lenses joined together. The lobster keeps its antennae and eye stalks moving constantly to search for food and to watch for enemies. Its antennae, legs, and shell are covered with millions of tiny hairlike sensors that can detect chemicals. The sensors help the animal locate food.

American lobsters have five pairs of jointed legs attached to the thorax. Four pairs are thin, and the lobster uses them for walking. The fifth pair, which extend in front of the head, are thick and end in large claws. The larger of these two claws has thick teeth to crush prey. The smaller claw has sharp teeth to tear food apart. All

lobsters do not have the heavy claw on the same side. Some are "right-handed," and others are "left-handed." Leglike structures called *swimmerets* are located under the abdomen and help the lobsters swim. Female lobsters also use swimmerets to hold eggs.

Life. American lobsters live on sandy, muddy, or rocky bottom areas. They usually hide in holes or under rocks at depths of 10 to 180 feet (3 to 55 meters). A lobster sits in its burrow all day, waving its feelers outside the entrance. It holds its claws ready and pounces on any prey that comes near. A lobster eats clams, crab, snails, small fish, and, occasionally, other lobsters. They also feed on algae and on plants called *eelgrass.* At night, it walks along the ocean bottom looking for food. If an enemy such as a large fish or an octopus comes near, the lobster scoots back into its burrow with powerful flips of its tail.

Young. A female lobster usually produces eggs only once every two years. She may produce 3,000 to nearly 100,000 eggs at a time. The number varies with her size and age. The eggs are covered with a sticky, gluelike substance and are attached to the swimmerets. The female carries the eggs for 10 to 11 months. When the eggs are ready to hatch, the lobster shakes the young out of the eggshells. Newborn lobsters are about $\frac{1}{3}$ inch (8 millimeters) long. They rise up in the water and drift and swim about for two to three weeks. At this time, they are easy prey for sea birds, fish, and other enemies. Then the lobsters sink to the ocean bottom where they spend the rest of their lives. Lobsters can live about 15 years or longer. But most never reach this age because they are captured by a variety of predators, including human beings.



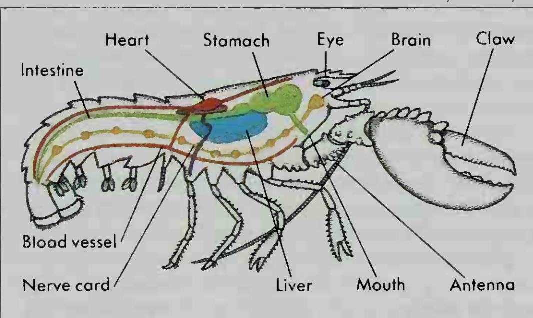
© Hank Morgan, Photo Researchers

Lobster pots are used to trap lobsters alive. The pots must be emptied almost daily or the lobsters will attack one another.

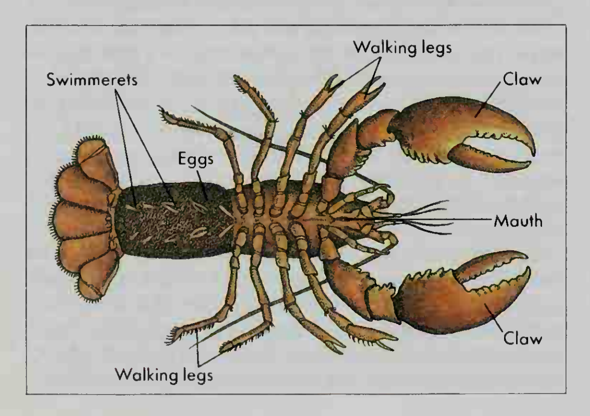
Growth. Lobsters *molt* (cast off their shells) as they grow. The animal loses its first shell within one week after hatching and molts three more times during the first month. When molting, the lobster's body gives off a substance that softens the shell. Then, by expanding its muscles, the lobster splits the shell and steps out of it. The new shell, which had formed under the old one, is soft and gives the lobster no protection. The animal hides from its enemies until the new shell hardens.

The body of an American lobster

WORLD BOOK illustrations by Patricia Wynne



Underside of a female American lobster



Lobster fishing

Lobster fishing is an important industry in many areas. Each year, millions of American lobsters are caught off the coast of Maine and farther north in Canadian waters. Spiny lobsters, which live in warm tropical seas, are caught off the coasts of California and Florida and in various parts of the Southern Hemisphere.

At one time, people caught so many American lobsters that the animals were in danger of dying out. Today, fishing laws protect lobster populations.

Lobsters are caught in traps called *pots* (cages made of narrow pieces of wood or metal). A lobster can enter the pot but cannot find the opening to get out.

The trap is baited with fish and lowered to the ocean floor. A float tied to a cord fastened to the trap shows the pot's location. The trap is usually raised and emptied every day or so. If two or more lobsters get in, they may fight and injure or kill one another. When a lobster is taken from a pot, each claw must be secured using special rubber bands or wooden or plastic *plugs* (nails). These tools keep the claws from opening.

Scientific classification. Lobsters belong to the order *Decapoda.* The American lobster is in the family *Nephropidae.* Its scientific name is *Homarus americanus.* Spiny lobsters belong to the family *Palinuridae.* Slipper lobsters are in the family *Scyllaridae.* Gregory M. Capelli

See also Crustacean; Maine (picture).

Lobworm. See Lugworm.

Local anesthesia. See Anesthesia.

Local government generally refers to the government of an area smaller than a country, state, or province. Such areas include counties, cities, towns, and villages. Each unit of local government has some important responsibility for the welfare of its citizens and provides certain services. Most local governments are run by elected officials and have some power of taxation. In the United States, each state government creates and has legal control over all local governments in the state.

Traditionally, Americans have strongly supported the principle of local self-government. Some scholars argue that small local governments are more responsive to citizens' wishes than are large units of government. They also feel that local governments encourage people to become involved in the life of their community. Other scholars believe that local governments have certain weaknesses. For example, they claim that an individual local unit often cannot deal effectively with such problems as transportation and pollution when they require the cooperation of other local units in the area.

This article deals mainly with local governments in the United States. The last section discusses local governments in other countries.

Units of local government

The United States has about 87,000 units of local government. There are four types of local governments: (1) *counties,* (2) *municipalities,* (3) *school districts,* and (4) *special districts.*

The county is the largest unit of local government in most states. The United States has about 3,000 counties. In Louisiana, these units are called *parishes.*

There are about 19,000 municipalities in the United States, including cities, villages, and townlike units called *boroughs.* They lie within each county or extend into two or more counties. Municipalities, often called *city governments,* are chartered by state governments to provide such services as police and fire protection.

School districts are responsible for running public school systems. There are about 15,000 school districts in the United States. Most school districts operate independently of city governments. The city governments of New York City and a few other communities in the Northeast operate their own public school systems.

Special districts are organized to provide one or more public services, such as mosquito control or transportation. There are about 33,000 special districts in the United States. The governing boards of these districts have the authority to levy taxes and to spend public money.

Functions of local government

Most of the activities of local government in the United States can be classified into three main groups: (1) health and safety functions, (2) welfare functions, and (3) housekeeping functions.

Health and safety functions of local government in the United States began with law enforcement by local police forces and through local courts. Today, most local governments also have responsibility for fighting fires, immunizing people against contagious diseases, and providing and maintaining hospital services, local roads, garbage collection, and safe drinking water. In addition, they conduct inspections and educational campaigns in the areas of health, housing, traffic safety, sanitation, and fire prevention. They are also concerned with reducing air pollution and water pollution.

Welfare functions. Early in U.S. history, local governments began to provide public education. Today, they spend more money on education than on any other function. Local governments also provide libraries, museums, parks and other recreational and athletic facilities, and buses and subways for mass transportation. They cooperate with other levels of government in providing public housing for low-income families. Many local governments have zoning restrictions to protect and promote the beauty and land values in their area. Many also try to stimulate economic growth by attracting business and industry to their area.

Providing health, safety, and welfare services is an important part of the American political process. Such questions as how much to spend for schools or whether to allow a factory to be built in a certain part of the city often cause conflicts among citizens and groups.

Housekeeping functions are administrative activities. They are essential to the function of a governmental unit but are not part of its main activities. One housekeeping function is keeping official records of births, deaths, marriages, and property transfers and assessments. Local governments also collect taxes, hire public agency workers, and administer elections.

Relations with higher levels of government

Government in the United States operates on three levels—national, state, and local. The U.S. Constitution grants certain powers to the federal and state governments, but it does not mention local governments. State legislatures, unless restricted by their state constitutions, have complete control over local governments. The states may specify what activities local governments can undertake, as well as the kinds of taxes and tax rates they can levy. Most of the states allow local governments to decide their own form of organization and to have considerable freedom in local matters. Such self-government is called *home rule.*

All three levels of government have increased their activities to deal with the growing problems of society. As a result, they share authority and responsibility in such matters as finance, education, and welfare. Many local governments receive a type of financial assistance called *grants-in-aid* from state governments to help pay for specific projects. Local governments—especially those of big cities—have also become increasingly dependent on federal aid. They receive federal grants directly or through payments transferred from their state government. In most cases, federal aid is provided only if local governments agree to follow state or federal requirements.

Issues confronting local governments

Local governments in the United States face many problems in trying to provide services for their residents. Many of these problems stem from population changes, financial difficulties, and conflicts in authority.

Population changes have affected local governments in the United States throughout its history. The movement of people from rural to urban areas is called *urbanization.* When the first census of the United States

was taken in 1790, only 5 percent of Americans lived in cities. In 1920, about 50 percent of Americans dwelled in cities. The 1990 census showed that about 75 percent of Americans live in urban areas. As populations have grown, demands for services have increased. However, urbanization seems to have slowed, and rural areas and small towns have begun to grow again.

Especially during the 1900's, American cities were confronted with *suburbanization,* the movement of people from the city to areas outside it. Many more white families than black families moved to the suburbs. Central city governments were typically poorer than suburban ones. Businesses also moved from cities to suburbs, which reduced jobs and economic opportunities in the cities.

The *urbanization of minority groups* also affected local governments. In 1910, only about 10 percent of African Americans lived in urban areas. Today, about 85 percent of them do. Millions of African Americans live in *ghettos,* crowded, decaying neighborhoods where minority groups are forced to live because of social and economic pressure. Racial conflicts in cities have presented difficult problems for local governments. During the 1960's, riots broke out in the black ghettos of Detroit, Los Angeles, Cleveland, and other cities. Black leaders complained about inferior schools, limited economic opportunities, and unfair treatment by police officers. These complaints are still common today. Local governments of major cities today also face the needs of growing Hispanic and Asian-American populations.

Local governments have also been affected by a *regional shift.* Cities in the South and West have grown in population, while cities in the Northeast have declined. Local governments in such rapidly growing cities as Phoenix and Las Vegas, Nevada, struggle to meet the service needs of growing populations, including transportation and water. Older cities, such as Philadelphia and St. Louis, face problems of declining populations and weakening economic opportunities. Local governments in older cities also must repair or replace deteriorating bridges, roads, school buildings, and other facilities, often called the *infrastructure.*

Financial difficulties. Traditionally, the major source of revenue for local governments has been property taxes. Local governments collect these taxes from homeowners, businesses, and other owners of taxable property. The amount of tax is based on the property's estimated value. Many object to property taxes. They point out that standards for *assessing* (determining the value of) property vary from city to city and from one assessor to another. Many also believe that property ownership is a poor measure of the ability to pay taxes.

People in many parts of the United States have protested the taxes collected by local governments. For example, in 1978, California voters approved an amendment to the state Constitution that reduced property taxes. This amendment was called *Proposition 13* because of its position on the ballot. As a result of its approval, many local governments in the state reduced services and laid off workers.

All municipalities have become more dependent on grants-in-aid from the state and federal governments. Some local governments have financial troubles despite aid from the higher levels of government. A few cities, including Cleveland and New York City, have come close to bankruptcy. Such financial problems are more severe in Northern cities that have lost many people and businesses.

Conflicts in authority. Almost every metropolitan area has a bewildering variety of local governments. The Chicago area has about 1,400 local governments. Philadelphia has about 875, and Houston has about 800. No one local government may have sufficient power to solve certain problems, and the different authorities with overlapping jurisdictions may find it difficult to work with one another.

Many experts on government believe that small, ineffective local units should be *consolidated* (combined) into larger, more efficient ones. At one time, cities solved part of this problem by *annexing* (adding) surrounding areas as the cities grew. But today, most large cities are surrounded by incorporated suburbs that the central city government could not annex if it wished to do so.

In some areas, citizens have tried to bring the central city and the suburbs under the authority of one government. This *metropolitan government* may be responsible for police protection, water supply, mass transportation, and other services that might be handled best by an areawide authority. The metropolitan areas of Miami and Jacksonville, Florida, and Nashville, Tennessee, have metropolitan governments. However, most U.S. voters have rejected such consolidation proposals because they fear higher taxes and believe that only small local governments can remain close to the people.

Although some citizens have worked for consolidation, others—especially those in large urban ghettos—have fought for more local control. Some blacks and members of other minority groups have demanded *decentralization* (splitting up) of authority to give neighborhood residents a greater say in controlling their own affairs and providing community services.

Local government in other countries

Local government takes various forms in different countries. The degree of local authority and independence also varies from nation to nation. In some countries, governmental authority has been decentralized so that many important decisions are made at the local level. In other countries, authority is centralized in the national government. Most countries have either a *federal* or a *unitary* system of government.

Federal systems divide the powers of government between the national government and the state or provincial governments. In most cases, the powers are set forth in a constitution. Although the state and provincial governments have legal control over local governments, they may give some authority to local units. Australia, Canada, Switzerland, and the United States have federal systems of government. Local governments usually have more authority under federal systems than they have under unitary systems.

Unitary systems give most of the chief powers to the central government. All local, state, and provincial governments are subject to control by the central government. They have only those powers that the central government gives them. France, Norway, Sweden, and the United Kingdom have unitary systems. In these coun-

tries, local areas have a considerable amount of self-government, though they are under the central government's control. Local areas have broad taxing powers and much authority for providing education, housing, and transportation.

Japan also has a unitary system of government. Tokyo, its capital, is one of the largest cities in the world. Local government in Japan is responsible for the same range of services—including police protection, transportation, and sanitation—that local governments in the United States are. But, as in most unitary systems, the central government of Japan exercises much tighter control over the activities of local governments. Tokyo's local government faces many huge problems. For example, the city needs a vast public transportation system to move millions of commuters to and from work.

Most Communist countries have had unitary systems. In these countries, decision making has traditionally been highly centralized at the national level. Local governments have operated almost completely according to the requirements of the central government. In Vietnam, for example, local government officials must follow Communist Party policies. The Communist Party chooses—and the people elect—the officials of the lower levels of local government. The lower level officials elect the members of the higher levels of local government.

Local governments in developing countries face especially severe problems. In most poor countries, rapidly increasing populations and limited economic opportunities in rural areas drive people to cities. Thus, urban populations swell rapidly. This condition is sometimes called *hyperurbanization.*

In the United States, the poorest ghettos are usually in the center of the city. But in most developing countries, the poorest areas are on the edges of the city. These vast areas of poverty present special problems for local governments. Sanitation is often nonexistent, schooling is limited, transportation is poor, and such services as police and fire protection are scarce. Even so, people from rural areas continue to come to the city, believing that economic opportunities are better there. These migrations swell urban populations, straining local governments that already lack the resources to care for their people. Robert L. Lineberry

Related articles. See **City government** and its list of *Related articles.* See also the following articles:

Constable
County
Home rule
School (Public school districts)
Sheriff
Sunshine laws
Township

Additional resources

Elliot, Jeffrey M., and Ali, Sheikh R. *The State and Local Government Political Dictionary.* 1988. Reprint. Borgo Pr., 1995.
Giesecke, Ernestine. *Local Government.* Heinemann Lib., 2000. Younger readers.
Wood, Len. *Local Government Dollars & Sense.* Training Shoppe, 1998.

Local option refers to the right of any political division, such as a city or state, to choose the conditions under which a law should apply in its own jurisdiction. In the United States, local option is often used to decide whether intoxicating liquors shall be sold and, if so, under what conditions. The privilege temporarily lost its force in the United States during the period of national prohibition (1917-1933). Today, a U.S. township, city, county, or state may again use local option to regulate the sale of liquor.

An act of legislature is required to give the right of local option to the people. Authority is then granted to the communities to license liquor stores and taverns. The legislature names the smallest political district in which local option may be used. A majority vote by the eligible voters in the district determines the choice. In Canada, provincial government control of liquor prevails.

Susan H. Ambler

See also **Prohibition.**

Locarno Conference, *loh KAHR noh,* resulted in the Rhineland Security Pact and six other treaties. The conference was called partly because the Treaty of Versailles, which ended military actions against Germany in World War I (1914-1918), failed to satisfy many nations and solve conflicts remaining after the war.

In October 1925, representatives of seven European countries met in Locarno, Switzerland, to discuss plans for building permanent peace in Europe. Delegates came from Belgium, the United Kingdom, Czechoslovakia, France, Germany, Italy, and Poland. The most important issue was to find a settlement between France and Germany. For the first time since World War I, the other nations treated Germany as a friendly nation.

The Rhineland Security Pact developed as the most important treaty. Belgium, the United Kingdom, France, Germany, and Italy signed the pact. Belgium, France, and Germany agreed never to fight each other again. Germany agreed to join the League of Nations, a forerunner to the United Nations. The treaty set up a neutral zone in the Rhineland, an area covering Belgian, French, and German soil. All signing powers vowed to guarantee France's and Belgium's borders with Germany.

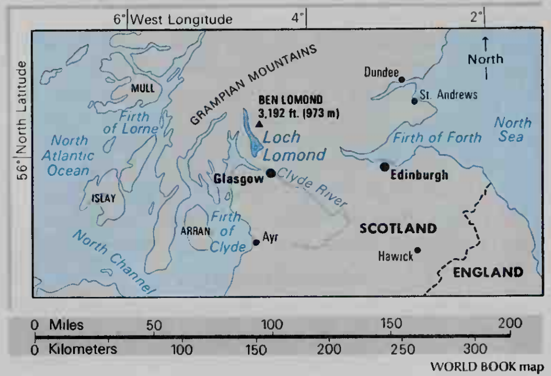
The six other Locarno Conference treaties bound the participating nations to the peaceful settlement of international quarrels. Each country promised to discuss its problems before resorting to war.

In 1936, Germany denounced the Locarno treaties and sent its troops into the neutral Rhineland. The other Locarno powers did not act to prevent such aggressions, which eventually brought on World War II (1939-1945).

Diane Shaver Clemens

Loch Lomond, *lahk LOH muhnd,* is the largest and one of the most famous of the Scottish lakes. The lake

Loch Lomond



WORLD BOOK map

lies in the Scottish Highlands, about 20 miles (32 kilometers) northwest of Glasgow. Loch Lomond is in a hilly region, and its waters have many islands. The lake is 23 miles (37 kilometers) long and 5 miles (8 kilometers) wide at its widest point. One of the most familiar Scottish folk songs is about Loch Lomond. A. S. Mather

Loch Ness monster, *lahk,* is a large animal that some people believe lives in Loch Ness, a lake in northern Scotland. If such a creature exists, it avoids people. But hundreds of people have reported seeing the animal, which is nicknamed "Nessie." The creature supposedly has flippers, one or two humps, and a long, slender neck. Some observers believe the Loch Ness monster may be related to a dinosaurlike reptile or to a modern sea animal, such as the manatee or seal.



Wide World

The Loch Ness monster was said to be the dark form in this photograph taken in 1934. But the photo probably was a hoax.

The earliest known description of a strange creature in Loch Ness dates from A.D. 565. Reported sightings increased during the 1930's, when a new highway made the lake more accessible to travelers. A photograph reportedly taken at Loch Ness in 1934 by R. Kenneth Wilson, a British physician, particularly sparked interest in Nessie. The photo shows a long, dinosaurlike neck and head extending out of the water.

Since 1960, several scientific expeditions have explored the waters of Loch Ness. Investigations with *sonar,* a device that uses sound to detect underwater objects, have found large moving bodies in the lake. However, scientists are not sure whether the sonar detected one large creature or a school of fish.

In 1972 and 1975, researchers from the Academy of Applied Science in Boston took underwater photographs of what they claimed was the Loch Ness monster. However, many experts question the value of these photographs. Subsequent expeditions have failed to produce any new evidence for Nessie's existence. In 1994, a London newspaper reported evidence that the 1934 Wilson photo of Nessie was a hoax. But Nessie's lure continues to attract tourists. Daniel Cohen

Additional resources

Campbell, Steuart. *The Loch Ness Monster.* Rev. ed. 1996. Reprint. Prometheus, 1997.
San Souci, Robert. *The Loch Ness Monster.* Greenhaven, 1989.

Lochner v. New York, *LAHK nuhr,* was a 1905 case in which the Supreme Court of the United States upheld the right of employer and employee to contract for working hours without government interference. The decision reflected the view that government should control business and industry as little as possible.

A New York state law limited bakers to a 60-hour workweek. By a 5-to-4 majority, the Supreme Court declared the law unconstitutional because it interfered with the "liberty of contract." This interpretation was a vague idea that some lawyers and judges derived from the 14th Amendment to the Constitution. Justice Oliver Wendell Holmes, in a dissenting opinion, said the ruling was based on "an economic theory which a large part of the country does not entertain." The court retained the same basic theory until 1937, when it began upholding laws regulating the economy. Gregg Ivers

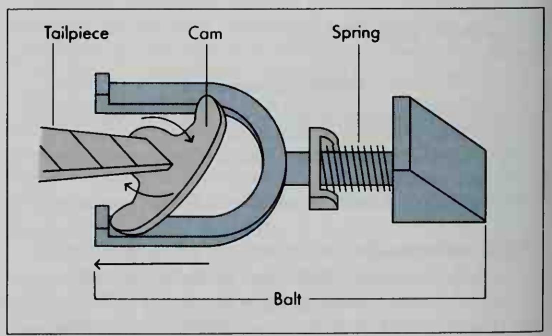
Lock is a device that prevents a door or other object from being opened, moved, or operated. People use locks to help protect themselves and to guard their property against theft.

Many locks open after a person inserts and turns the correct key. But others, for example a combination lock, are opened by pressing a series of buttons on a keypad or by turning a dial to the correct sequence of numbers or letters. Some electronic locks are opened by inserting a specially coded "key card." Sophisticated electronic locks open after a computer has identified a feature, such as a fingerprint, of the person desiring access.

Types of locks

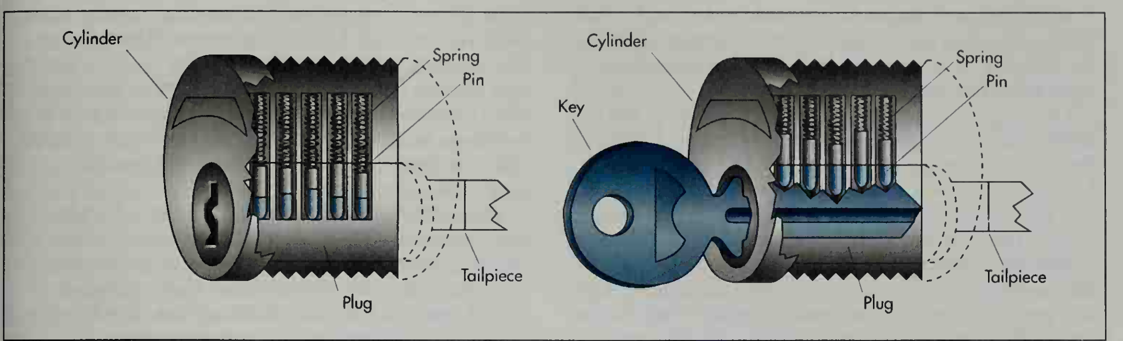
There are many ways to name or describe a lock. Broad terms, such as door lock or car lock, refer to a lock's general purpose. More specific names describe a lock more exactly. For example, the terms *key-in-knob lock* and *lever lock* both describe types of handles commonly used on door locks.

Lock terms also describe a lock's mechanical features. The type of *bolt*—the long piece of metal that holds the door shut—is an important feature in door locks. A lock with a bolt called a *spring latch* is convenient, because it can be locked without a key. As the door closes, the doorframe presses on the bolt. This pressure squeezes a metal spring, making the bolt retract into the door. When the door is fully closed, the bolt is aligned with the *strike,* a metal plate on the doorframe that has a hollow area to receive the bolt. The spring then automati-



WORLD BOOK diagram by Zorica Dabich

The bolt of a door lock slides back and forth. A piece of metal called a *cam* controls the movement of the bolt.



WORLD BOOK illustration by Bensen Studios

A pin-tumbler lock contains an inner core called a *plug,* which rotates inside a larger cylinder. Springs push pins into the plug, *left,* and keep it from rotating. If the proper key is inserted, *right,* it moves the pins into alignment, allowing the plug to turn and the lock to open.

cally pushes the bolt into the strike in the locked position. However, an intruder can easily pry open a spring latch. Locks with *deadbolts* are more secure. Because deadbolts lack the spring feature, they must be moved into both their locked and unlocked positions by using a key or by turning a knob or handle.

Most door locks need a key to be unlocked only from the outside. A person opens such devices, called *single-cylinder locks,* from the inside by pushing a button or by turning a knob or handle. *Double-cylinder locks* require a key to be locked or unlocked from both sides.

Locksmiths often refer to locks based on their installation method. For example, a *rim lock* is a lock that mounts on the surface, or rim, of a door or object. A *mortise lock* is installed in a hollowed out, or mortised, cavity. *Padlocks* are portable locks.

This article divides locks into two groups, mechanical and electric, according to how they work.

Mechanical locks have moving parts that operate without electric current. There are two types of mechanical locks: warded and tumbler.

Warded locks have several fixed ridges or obstacles called *wards* that block the wrong key from operating the lock. The correct key has notches cut into it that match the wards inside the lock. When a person inserts the correct key, the key fits past the wards and moves a spring inside the lock. The spring is attached to a bolt or *shackle*—the curved part of a padlock that snaps into the padlock's body. When the spring moves, the bolt or shackle slides to a locked or unlocked position.

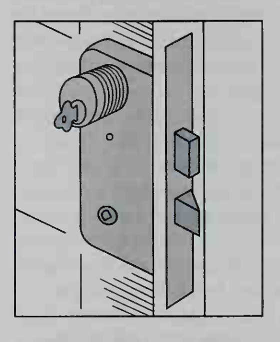
Warded locks are easy to *pick* (unlock) with a stiff piece of wire or thin strip of metal. Therefore, people should use warded locks in areas that do not require much security, such as closet doors.

Tumbler locks have movable metal parts called *tumblers* that prevent the wrong key from opening the lock. Because tumblers provide more security than wards, most door locks use some type of tumbler arrangement.

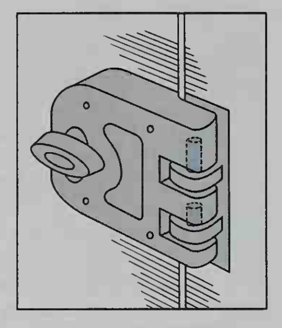
The main part of a tumbler lock is the *cylinder,* also called the *housing.* The cylinder houses springs, tumblers, and a rotating inner core called a *plug.* The tumblers block the plug from turning until the proper key moves them into alignment. A piece of metal called a *cam* or a metal strip called a *tailpiece* links the end of the plug to the bolt. When the key turns the plug, the cam or tailpiece slides the bolt in or out of the strike.

There are three types of tumbler locks: (1) pin-tumbler locks, (2) disk-tumbler locks, and (3) lever-tumbler locks. Pin-tumbler locks are the most common. Tumblers in this type of lock are small pins. Most door locks on homes are pin-tumbler locks. Many automobile locks and most high-security locks also have this mechanism.

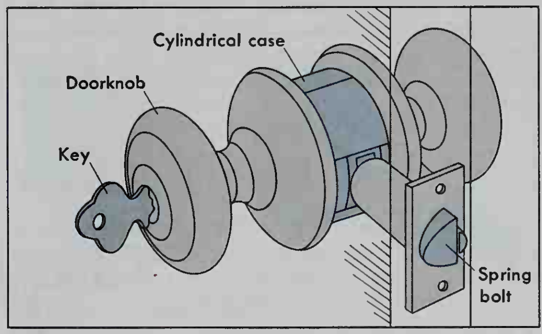
Disk-tumbler locks, also called *wafer-tumbler locks,* have flat disk tumblers instead of pins. When a person inserts the correct key or enters the correct combination, the disks retract into the plug. This action enables the plug to rotate and release the bolt. Many desks and file cabinets have disk-tumbler locks.



A mortise lock is cut into the edge of a door. This one has a spring latch and a deadbolt.



A rim lock has a bolt enclosed in a frame mounted on the inside surface of the door.



WORLD BOOK diagrams by Zorica Dabich

A key-in-knob lock has a locking mechanism that is part of the doorknob. Most of these locks have a spring latch.

A *combination padlock* is a special disk-tumbler lock. It has a movable dial with a series of numbers around it. To open the lock, a person must turn the dial left and right in the correct sequence of numbers.

Lever-tumbler locks have a series of different-sized levers that act as tumblers. The levers rest on a bolt pin that prevents the bolt from moving. As a user turns the key, all the levers are raised to the same height. This action enables the bolt pin to move and release the bolt. Many briefcases and lockers have lever-tumbler locks.

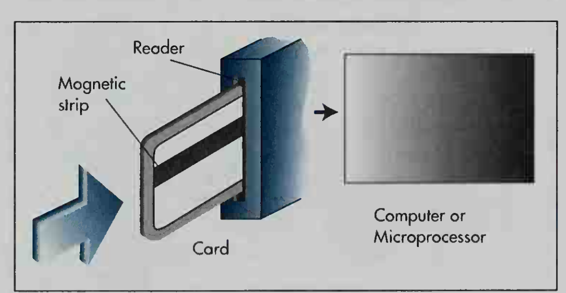
Electric locks require electric current to operate. Many electric locks include electronic devices, such as scanners that identify users and computers that process codes. Types of electric locks include (1) card access systems, (2) electronic combination locks, (3) biometric entry systems, and (4) electromagnetic locks.

Card access systems, used in many hotels and office buildings, are the most common electronic lock systems. A person desiring access needs a card or a special "key" to unlock a door. One system uses a paperboard or plastic card, on which the code appears as a series of holes or bumps. Another system uses cards or keys that have their code on a microchip or a magnetic strip. A device reads the code and sends the information to a computer. If the code matches the one in the computer's memory, the locking mechanism releases the bolt and the door opens.

Electronic combination locks are used in many stores and other businesses. Some electronic combination locks open after a person enters the correct combination on a numbered keypad. Other types require the user to turn a dial to enter a series of numbers. Once the person completes the combination, the computer compares it with the combination stored in its memory. If the codes match, the door opens.

Biometric entry systems identify a person by using a computer to compare the unique features of a fingerprint, palm, voice, eye, or signature with the one in its memory. In a fingerprint system, for example, a person who wants to open the door places his or her finger on a plate. A scanner analyzes the print. If it matches the information in the computer's memory, the door will unlock. Biometric entry systems are most often used in high-security areas, such as nuclear power plants.

Electromagnetic locks use magnetism rather than bolts to hold a door shut. In these locks, a metal strike is mounted on the top of the door. A strong electromagnet, a device that acts as a magnet when electric current flows through it, is fastened to the doorframe in alignment with the strike. When the current flows, the electromagnet attracts the strike. Stopping the flow of current unlocks the door. Doors with electromagnetic locks often provide additional emergency exits from such buildings as schools, libraries, and museums. In some electromagnetic systems, the doors automatically unlock when a fire alarm is activated.



WORLD BOOK illustration by Bensen Studios

A card access system uses a card with a coded magnetic strip as a key. A device reads the code, and a tiny built-in computer called a *microprocessor* unlocks the door if the code is valid.

Other kinds of electric locks include some types of time locks and delayed-access timers. Time locks are designed to open only at certain times on certain days. They are commonly used on bank vaults. Delayed-access timers are often used on safes in convenience stores, fast-food restaurants, and gas stations. Once the correct combination has been entered, a safe protected by such a timer can only be opened after a preset time has passed.

The development of the lock

The oldest key-operated lock still in existence was found in the citadel of King Sargon II. The citadel was built in the Assyrian capital of Khorsabad in the late 700's B.C. Similar locks are shown in Egyptian art dating from about 2000 B.C. These large wooden locks had bolts with pegs that served as simple pin-tumblers. A matching wooden key raised the tumblers and released the bolt.

The ancient Romans developed the first warded locks. Warded locks remained the most common locks until the 1800's.

Improvements in lock design came rapidly during the late 1700's and 1800's. Robert Barron, an English inventor, patented the first lever-tumbler lock in 1778. In 1784, Joseph Bramah, an English locksmith, patented the first high-security lock operated by a small, easy-to-use key. In 1861 and 1865, the American locksmith Linus Yale, Jr., patented improvements that enabled pin-tumbler locks to be mass produced. American inventor James Sargent devised the modern time lock in 1872. Card access systems and other electronic locks were introduced in the 1970's. Bill Phillips

Locke, Alain LeRoy (1885-1954), was an African American educator, philosopher, and writer. An authority on African American culture, Locke played a major role in promoting the careers of black writers and artists and encouraging serious critical review of their work.

In 1925, Locke organized and edited an issue of the magazine *Survey* titled "Harlem, Mecca of the New Negro," which included contributions from black writers. In the issue's lead essay, Locke presented the writings as evidence of the renewed artistic and cultural life in the African American community. Locke expanded the magazine issue into a book, *The New Negro* (1925), a rich collection of African American literature. Locke emerged as the principal voice for what he called "The New Negro Movement," commonly known as the "Harlem Renaissance."

Locke was born in Philadelphia. He was a brilliant student and became the first African American to receive a Rhodes Scholarship to study at Oxford University in England. Brad S. Born

See also American literature (The Harlem Renaissance).

Locke, David Ross. See Nasby, Petroleum Vesuvius.

Locke, John (1632-1704), was an English philosopher. His writings have influenced political science and philosophy. Locke's book *Two Treatises of Government* (1690) strongly influenced Thomas Jefferson in the writing of the Declaration of Independence.

His life. Locke was born in Wrington in Somerset County. He attended Oxford University. In 1666, he met Anthony Ashley Cooper, who later became the first Earl of Shaftesbury. The two men became close friends. In 1679, the earl became involved in plots against the king, and suspicion also fell on Locke. The philosopher decided to leave England. In 1683, he moved to the Netherlands, where he met Prince William and Princess Mary of Orange. William and Mary became the rulers of England in 1689, and Locke returned to England as a court favorite. Until his death, he wrote widely on such subjects as educational reform, freedom of the press, and religious tolerance.

His philosophy. Locke's major work was *An Essay Concerning Human Understanding* (1690). It describes his theory of how the mind functions in learning about the world. Locke argued against the doctrine of innate ideas, which stated that ideas were part of the mind at birth and not learned or acquired later from outside sources. Locke claimed that all ideas were placed in the mind by experience. He declared that there were two kinds of experience, outer and inner. Outer experience was acquired through the senses of sight, taste, hearing, smell, and touch, which provide information about the external world. Inner experience was acquired by thinking about the mental processes involved in sifting these data, which furnished information about the mind.

Locke believed that the universe contained three kinds of things—minds, various types of bodies, and God. Bodies had two kinds of properties. One kind was mathematically measurable, such as length and weight, and existed in the bodies themselves. The second kind was qualitative, such as sound and color. These properties were not in the bodies themselves but were simply powers that bodies had to produce ideas of colors and sounds in the mind.

According to Locke, a good life was a life of pleasure. Pleasure and pain were simple ideas that accompanied nearly all human experiences. Ethical action involved determining which act in a given situation would produce the greatest pleasure—and then performing that act. Locke also believed that God had established divine law. This law could be discovered by reason, and to disobey it was morally wrong. Locke thought that divine law and the pleasure principle were compatible.

Locke believed that people by nature had certain rights and duties. These rights included liberty, life, and ownership of property. By liberty, Locke meant political equality. The task of any state was to protect people's rights. States inconvenience people in various ways. Therefore, the justification for a state's existence had to be found in its ability to protect human rights better than individuals could on their own. Locke declared that if a government did not adequately protect the rights of its citizens, they had the right to find other rulers.

Douglas M. Jesseph

See also **Civil rights** (Natural rights); **Democracy** (Democracy in England); **Empiricism**; **Philosophy** (Modern philosophy).

Additional resources

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Lockjaw. See Tetanus.

Lockout occurs when an employer closes a plant in order to keep employees from working. The employer is using the economic weapon of a work and wage stoppage to get employees to agree to some particular condition of work or wages. The lockout is like the *strike* in that it is an economic weapon used in labor disputes. The lockout differs from the strike, however, because the strike is a work stoppage the employees start to compel the employer to meet certain demands.

Lockouts, like strikes, are usually caused by wage disputes. But the number of lockouts is far less than the number of strikes. Lockouts make up only about 3 to 4 per cent of the total number of work stoppages that occur. The reason the percentage is so low is that employers are reluctant to shut their own facilities. They sometimes have more direct and effective means of placing economic pressure on workers, such as replacing workers involved in labor disputes. Daniel Quinn Mills

See also **Strike** (Kinds of strikes).

Lockwood, Belva Ann Bennett (1830-1917), was a reformer and woman-suffrage leader. She was one of the few women nominated for president of the United States. She taught school for many years, and became a lawyer in 1873. She worked for women's rights, and won equal pay for women government employees and a law allowing women to practice before the Supreme Court. She also successfully defended land rights of the North Carolina Cherokee Indians. In 1884 and 1888, the Equal Rights Party nominated her for president. She was born in Royalton, New York. Louis Filler


Brown Bros.
Belva Lockwood

Lockwood, Lorna. See **Arizona** (The mid-1900's).

Locofocos was a nickname given in 1835 to radical members of the New York Democratic Party. In October 1835, New York Democrats held a meeting in Tammany Hall. Radical Democrats proposed that the party dedicate itself to a push for banking reform. Conservative party members opposed the proposal but were not strong enough to defeat it. They turned out the lights and left the hall. Members of the radical group used newly invented phosphorus friction matches, called locofocos, to light candles. They then continued the meeting. As a result, reform Democrats became known as Locofocos. William W. Freehling

Locomotion, in zoology, is the act of animals moving. See **Animal** (Adaptations for moving about); **Insect** (The bodies of insects); **Mammal** (How mammals move).



A diesel-electric locomotive, *shown here,* is the most widely used kind of diesel in the world. Diesel locomotives pull most freight and passenger trains and handle most yard-switching.

© General Motors Corporation. Used with permission of GM Media Archives

Locomotive is a machine that moves trains on railroad tracks. It is sometimes called a *railroad engine.* Locomotives of the early 1830's weighed from 5 to 8 tons (4.5 to 7.3 metric tons) and could pull or push only a few light cars. A modern diesel locomotive may weigh over 210 tons (190 metric tons). Modern locomotives often use *multiple-unit* operation. In multiple-unit operation, two or more locomotives are linked together under the control of a single engineer. Several modern diesel locomotives working together in multiple-unit operation can pull 200 or more loaded freight cars at one time.

A locomotive by itself, or a locomotive with a permanently attached fuel car called a *tender,* is not a train. The term *train* refers to a combination of railroad cars or to a combination of at least one locomotive coupled to one or more cars for passengers or freight. A train can also consist of self-propelled cars that do not require a separate locomotive.

Kinds of locomotives

Locomotives may be grouped by the type of work they do. *Road locomotives* haul trains over long distances. They include *passenger locomotives* and *freight locomotives.* Passenger locomotives pull trains designed to carry travelers. In addition, passenger locomotives often supply electric current to passenger cars for lighting, heating, and air conditioning. Freight locomotives pull cars designed to carry heavy cargo, such as grain, coal, liquids, manufactured goods, lumber, highway trailers, and freight containers. *Switching locomotives* move cars from track to track in railroad yards. They are typically not as powerful as road locomotives. Freight and switching locomotives can also pull work trains that repair railroad tracks or clear snow.

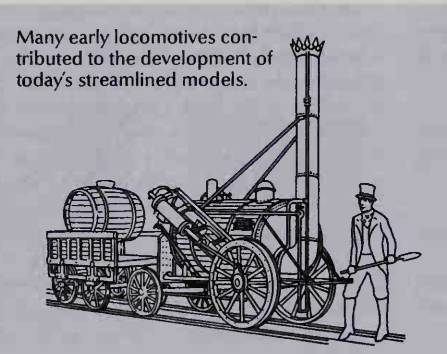
Locomotives can also be grouped according to their source of power. The three major types include: (1) diesel, (2) electric, and (3) steam. A fourth kind of power source is the *gas turbine,* a form of jet engine that can drive a generator to make electricity. Gas turbines combined with generators are used to power some lightweight, self-propelled rail cars that carry passengers. Individual locomotives of the three major types generally range from about 400 horsepower (300 kilowatts) to 6,000 horsepower (4,500 kilowatts), though some provide over 10,000 horsepower (7,500 kilowatts).

Diesel locomotives are the most common type of locomotive worldwide. Diesel engines generally convert fuel to energy more efficiently than engines that burn other fuels.

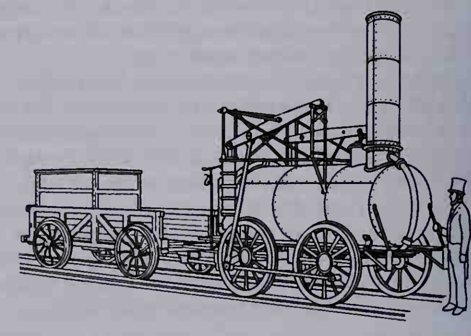
The most common kind of diesel locomotive is the *diesel-electric locomotive.* Diesel-electric locomotives function like traveling power plants. In a diesel-electric locomotive, a powerful diesel engine drives a large electric generator.



Historic locomotives Many early locomotives contributed to the development of today's streamlined models.



The ***Rocket,*** the first truly successful steam locomotive, was built by Robert Stephenson of England in 1829.



The ***Stourbridge Lion,*** a steam engine, in 1829 became the first full-sized locomotive to run in North America.



© AP/Wide World

An electric locomotive runs on power supplied by an electric power plant. This type of locomotive is especially useful for hauling high-speed passenger trains or fast, heavy freight trains.



E. R. Degginger

A steam locomotive like this one hauled nearly all trains before the invention of the diesel. Today, steam locomotives haul freight and passenger trains in only a few remote areas of the world.

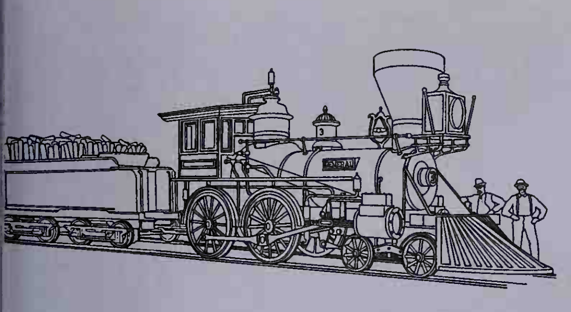
Each axle of a modern diesel-electric locomotive is fitted with a *traction motor,* a compact, specialized electric motor. The generator sends a powerful electric current to each traction motor. Each motor uses a pair of gears to turn the axles on the locomotive's *driving wheels.* The driving wheels move the train.

The engineer controls the speed of a diesel-electric locomotive using levers for the vehicle's *throttle* and *dynamic brake.* The throttle lever increases or decreases the power output of the diesel engine, which, in turn, varies the amount of current produced by the generator. When the amount of current sent to the traction motors increases, the train goes faster. Application of the dynamic brake causes the traction motors to function temporarily as generators. The spinning motion of the locomotive's axles is thus converted into electric current, creating electrical resistance. This resistance against the turning axles slows the train. Locomotives are equipped with both dynamic brakes and *air brakes.* Air brakes are a series of brakes connected by *pneumatic lines* (hoses that hold pressurized air). All the cars in a train have air brakes. The engineer activates the air brakes from the locomotive by using controls to change the air pressure in the pneumatic lines. If there is a loss in air pressure, all the air brakes activate automatically.

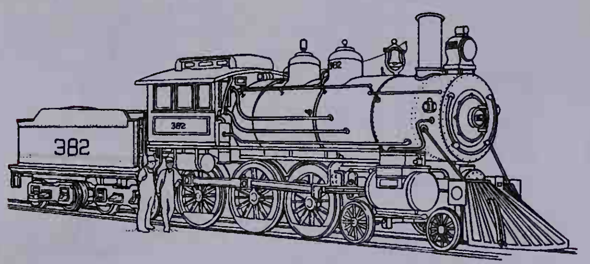
Diesel locomotives frequently run in multiple-unit operation. Electrical and pneumatic lines connect the *units* (locomotives) so that all controls operate from the lead unit. Connected this way, two to six freight locomotives commonly pull trains weighing from 5,000 tons (4,550 metric tons) to more than 20,000 tons (18,100 metric tons).

Sometimes, two or more *remote control units* help pull extremely long freight trains. These units are located near the middle of the train. The engineer controls them from the lead unit using radio signals. On steep slopes, *pusher units,* also called *helper units,* assist long freight trains. One or more pusher units under the control of a separate crew may push at the rear of a freight train going uphill. Such units may also assist with extra dynamic braking when a train is going downhill.

Early diesel-electric locomotives used generators that produced *direct current* (DC), a kind of current that flows in only one direction. More efficient generators producing *alternating current* (AC), current that reverses direction many times per second, have been used in locomotives since the 1970's. Until the 1990's, most traction motors operated on direct current. Locomotives with AC generators used devices that *rectified* (converted) the alternating current into direct current before it went to the motors. Today, many locomotives use computer-controlled AC traction motors. These motors can produce greater power at each driving axle and do not overheat as easily as DC traction motors.



The *General,* a Confederate steam locomotive, became famous after Union troops captured it in 1862 in the American Civil War.



Engine 382 was the locomotive driven by the famous engineer Casey Jones, who in 1900 gave his life to save his passengers.

Parts of a diesel-electric locomotive

Control stand
Horn
Dynamic brake cooling fans
Radiator cooling fans
Radiators
Air compressor
Traction motors
Coupler
Generator
Diesel engine
Diesel fuel tank
Air brakes
Coupler

Electro-Motive Division of General Motors Corporation (WORLD BOOK diagram)

Inside a diesel-electric locomotive, a diesel engine turns a generator. Electricity produced by the generator runs the traction motors on the axles that drive the wheels. An engineer regulates power and speed at the control stand, and the air compressor powers the brakes. The radiator equipment keeps the engine from overheating. *Couplers* connect the locomotive with other units.

In modern diesel-electric locomotives, computers control fuel flow, engine efficiency, and traction at the driving wheels. As a result, these locomotives can produce more power using less fuel than older ones. Electronic traction-control systems help prevent wheel slipping and allow the highest *torque* (rotating force) to be applied to the driving wheels.

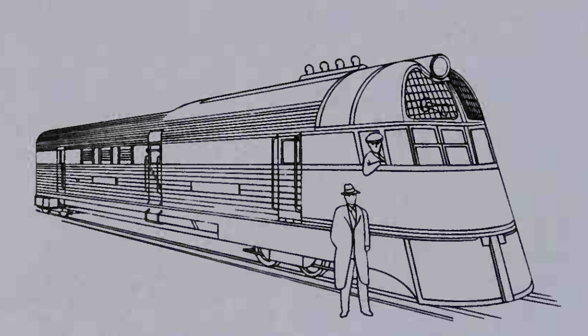
Two other kinds of diesel locomotives are *diesel-hydraulic locomotives* and *diesel-mechanical locomotives.* Diesel-hydraulic locomotives use fluid under pressure to transmit power from the engine to the driving wheels. A diesel-mechanical locomotive transmits power to the driving wheels using a system of gears and rods, much like an ordinary automobile engine. Neither of these two types of locomotives is widely used today.

Electric locomotives, unlike diesels, do not produce their own power. They use electric current supplied by a stationary central generating station. This station is a power plant that produces electric current using coal, natural gas, water power, nuclear energy, or petroleum. Alternating current generated at the station flows through a *contact wire.* A system of suspension wires holds the contact wire over the railroad tracks at an even height. The contact wire, together with the suspension wires, is called the *catenary.*

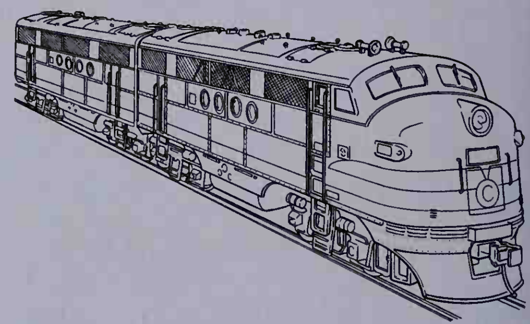
The roof of each locomotive carries one or two *pantographs,* hinged devices that collect current from the contact wire. Inside the body of the locomotive, the current passes through one or more *transformers.* Transformers *step down* (reduce) the voltage to that required by the motors. The current is then fed to AC traction motors, or it is rectified and fed to DC traction motors. Like diesels, electric locomotives can run either singly or they can be combined in multiple-unit operation.

Electric locomotives are numerous in China, Japan, several European nations, and a few other countries. Among the trains they power are the world's fastest—including France's *TGV (train à grande vitesse),* Japan's *Shinkansen,* Germany's *ICE (Inter-City Express)* train, Sweden's *X2000,* and the *Acela* in the United States.

An electrified railway network is expensive to build and maintain. Throughout the world, most electrified



The Burlington *Zephyr* was the first streamlined passenger diesel in the United States. It went into operation in 1934.



The *FT* met heavy freight-hauling demands during World War II (1939-1945). This diesel went into operation in 1939.

railroads have required government support to be built and maintained.

Steam locomotives. Steam engines powered the first locomotives ever built. These engines burn coal, fuel oil, or wood in a special furnace called a *firebox.* The heat turns water in the engine's boiler into steam. In many locomotives, the steam is then *superheated* (heated beyond boiling temperature) before being fed into two or more cylinders. In each cylinder, the steam pushes against a disc called a *piston.* Special valves control the flow of steam, causing it to press against one side of the piston and then the other. This alternating pressure creates a *reciprocating* (back-and-forth) motion. See **Steam engine** (Reciprocating steam engines).

Steam locomotives use connectors called *main rods* and *side rods* to transmit power from the pistons to the driving wheels. Most steam locomotives have a permanently attached tender that carries fuel and water for the firebox and boiler.

From the 1830's until the 1950's, steam locomotives pulled nearly all railroad trains. However, steam locomotives proved less reliable and less efficient than more modern locomotives. Most steam locomotives in use today pull special excursion trains for tourists and railroad enthusiasts. In a few countries, steam locomotives still haul freight or passenger trains in remote areas.

History

The earliest locomotives were invented and developed in the United Kingdom. The British engineer Richard Trevithick built a steam locomotive in 1804. Steam locomotives were hauling cars around British coal mines by 1813. In 1829, the British engineer Robert Stephenson designed and built the *Rocket,* the first steam locomotive suitable for high-speed, long-distance use. That year, a canal company in New York imported four British locomotives for use in Pennsylvania. One of these, the *Stourbridge Lion,* became the first locomotive to operate on a commercial railroad in the United States.

In late 1830, a rail line in Charleston, South Carolina, bought a locomotive from a foundry in New York. The locomotive, called *The Best Friend of Charleston,* soon began regular operation. Railroad systems developed rapidly in France, Germany, the United Kingdom, and the United States. The Baltimore and Ohio, the first U.S. railroad company, began using locomotives in the early 1830's.

In 1893, the New York Central locomotive *999* became the first vehicle to travel faster than 100 miles (160 kilometers) per hour. By 1900, locomotives transported 80 to 90 percent of people and cargo traveling between cities. In 1920, nearly 70,000 locomotives, most of them steam-powered, operated throughout the United States.

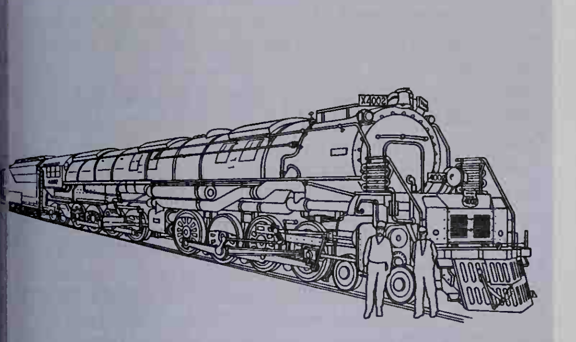
In the late 1800's, many inventors tried to develop an electric locomotive. The American inventor Thomas Edison tested his first model in 1880. The first electric street railway began operating in Germany in 1881. In 1895, the Baltimore and Ohio first put electric locomotives into daily use. In the early 1900's, a few U.S. railroads converted long sections of rail line to electric operation in parts of the East and the Pacific Northwest. In Europe, shorter distances between major cities favored the spread of electric rail lines.

Engineers began seriously to develop diesel locomotives in the early 1920's. In 1925, the first diesel in regular use in the United States began switching operations in a New York City freight yard. The first passenger diesel train in the United States, the Burlington Railroad's *Zephyr,* entered service in 1934. Diesel locomotives began hauling heavy freight in 1939. Diesel locomotives proved their reliability and economy during World War II (1939-1945). They helped handle the huge amounts of domestic rail traffic and large shipments of military supplies demanded by the war effort. Manufacturers also continued to build steam locomotives. The heaviest and most powerful steam locomotives ever, the *Big Boys* and the *Alleghenys,* were designed in 1941 and served until the 1950's. By 1947, 90 percent of new locomotives were diesel. In 1960, the last steam locomotives in general use in the United States and Canada were retired.

Today's diesel locomotives have advanced well beyond those of the 1940's and 1950's. Computerized traction control systems and more efficient engines and motors have helped increase power and improve fuel economy. Better brakes and on-board diagnostic systems have made rail travel safer.

Today, in France and Japan, electric-powered trains run daily at speeds of 180 miles (290 kilometers) per hour or more. Research engineers work to further improve the safety, reliability, and economy of both diesel and electric locomotives. William L. Withuhn

WORLD BOOK illustrations by Jackson-Zender and Rolin Graphics



The *Big Boy* engine of the Union Pacific Railroad, built in the 1940's, was the heaviest steam locomotive in history.

Related articles in *World Book* include:

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Cooper, Peter
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Electric generator
Electric motor
Electric railroad
Jones, Casey
Railroad
Railroad, Model
Rocket [locomotive]
Steam engine
Stephenson, George
Stephenson, Robert
Trevithick, Richard
Turbine
Westinghouse, George

Additional resources

Drury, George H. *Guide to North American Steam Locomotives.* Kalmbach, 1993.

Foster, Gerald L. *A Field Guide to Trains of North America.* Houghton, 1996.

Marre, Louis A., and others. *The Contemporary Diesel Spotter's Guide.* 2nd ed. Kalmbach, 1995.

Riley, C. J. *The Encyclopedia of Trains & Locomotives.* Michael Friedman, 1994.

Locomotor ataxia. See Ataxia.

Locoweed is the name of a large group of poisonous herbs that grow in western North America. Locoweeds have harmful effects when they are eaten by horses, cattle, or sheep. The name *locoweed* comes from the Spanish word for *crazy,* because of the strange actions of animals poisoned by the plants.

There are about a hundred kinds of locoweeds. Three of the more common kinds are the *Lambert crazyweed,* the *woolly loco,* and the *blue loco.* Locoweeds have erect or spreading stems with many leaflets on each stem.

The effect of locoweeds on animals depends on the soil in which the plants grow. Scientists believe that the plants' poisonous effects result from their ability to absorb large amounts of the element selenium from the soil.

The symptoms of poisoning vary somewhat in horses, cattle, and sheep. Horses become dull, drag their legs, eat infrequently, and lose muscle control. Soon they become thin and die. Cattle react in much the same way. But sometimes they run wildly about, bumping into objects in their path. Sheep react more mildly to the poison.

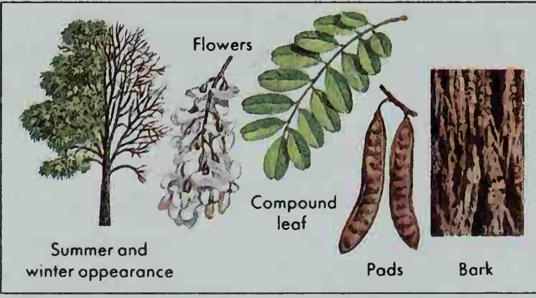
Animals that are raised on a range usually do not eat locoweeds when other food is available. Ranchers destroy locoweeds by cutting the roots about 2 inches (5 centimeters) below the surface of the soil. They also kill the plants by spraying them with a herbicide.

Jerry M. Baskin

Scientific classification. Locoweeds belong to the pea family, Fabaceae or Leguminosae. The scientific name for the Lambert crazyweed is *Oxytropis lambertii;* the woolly loco is *Astragalus mollissimus;* and the blue loco is *Astragalus diphysus.*

Locust is any of about 20 plants native to North America. Four of these are shade trees with heavily scented flowers. The others are shrubs. The trees sometimes grow about 80 feet (24 meters) tall.

In the United States, the *black locust* is the best-known locust tree. This medium-sized tree grows widely throughout the Eastern United States and southern Canada. It also is one of the most widely planted North American trees in Europe. Like most locusts, the black locust has prickly branches. Its fragrant white flowers hang in drooping clusters. The fruit of the locust tree consists of a long, glossy brown pod with about a dozen wax-coated seeds. Black locusts have blue-green compound leaves. The bark and leaves of the black locust are poisonous.



WORLD BOOK illustration by John D. Dawson

The black locust is a popular North American shade tree.



© Heather Angel

A black locust has blue-green leaves and drooping clusters of fragrant flowers. Its bark and leaves are poisonous.

Locusts grow rapidly on good soil. However, on poor soils, locust borers kill the trees while they are still young. Another insect enemy, the *leaf miner,* may cause the trees' leaves to turn yellow and fall off before the first frost.

Locust wood is commercially important because it is hard, lasts for a long time, and swells only slightly when wet. Locust trees make good fence posts and mine timbers. Richard C. Schlesinger

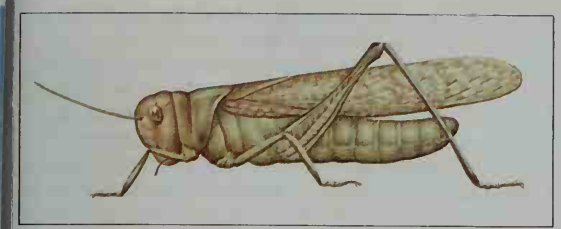
Scientific classification. Locusts belong to the pea family, Fabaceae or Leguminosae. The scientific name for the black locust is *Robinia pseudoacacia.*

See also Acacia; Honey locust; Tree (Familiar broadleaf and needleleaf trees [picture]).

Locust is a name that can refer to any short-horned grasshopper—that is, a grasshopper that has short *antennae* (feelers). However, the name *locust* is most often given to short-horned grasshoppers that migrate. There are about nine kinds of these grasshoppers. Every continent except Antarctica has its own kind of migratory locust. The long-horned grasshoppers and katydids belong to another family of insects. A number of cicadas also are called locusts, but they, too, belong to a different family.

Most migratory locusts measure about 2 inches (5 centimeters) long. Most of these locusts have a large head, large eyes, and short antennae. They have long hind legs for jumping, and four wings that fold over their backs when they are not flying. Many locusts can make a sound by rubbing their ridged hind legs on their front wings. This rubbing causes the wings to vibrate and makes the noise.

Conditions that cause the migration of locusts are not fully understood. However, scientists know that migration takes place only after a large number of females lay their eggs close together. This may occur because of a food shortage or because of local flooding. The young that hatch from these eggs remain together and live as a



WORLD BOOK illustration by Shirley Hooper, Oxford Illustrators Limited

The locust, a type of grasshopper, has a large head, short antennae, and long legs. Its wings help it fly great distances.



© Gianni Tortoli, Photo Researchers

A swarm of locusts flies over a field in Eritrea. Since ancient times, locusts have plagued farmers throughout the world.

group. They meet other groups of young grasshoppers and form a swarm. There may be billions of migratory grasshoppers in a locust swarm. The adults may fly long distances. Wherever they land, they eat and destroy vegetation. Eventually, the locusts become separated. Many generations of solitary locusts may be produced before conditions are right to produce another swarm.

Plagues of crop-destroying locusts have been known since ancient times. One swarm by the Red Sea was believed to cover an area of 2,000 square miles (5,200 square kilometers). The Rocky Mountain locust destroyed millions of dollars worth of crops in the Mississippi Valley between 1870 and 1880. Between 1930 and 1940, migratory grasshoppers caused damage on the Pacific Coast, in the Southwest United States, and on the eastern side of the Rocky Mountains.

Swarms of migrating locusts are sometimes so large they shut out the sunlight. They interfere with railroad trains and airplanes and make automobile travel dangerous. Millions of crushed locust bodies make rails and highways slippery. Swarms have traveled from Saskatchewan, Canada, to Texas. Others have been seen as much as 1,200 miles (1,930 kilometers) from land.

Scientists and farmers have found several ways to fight locusts. Because grasshoppers lay their eggs in the fall, plowing the soil in the late fall destroys the eggs. When large numbers of grasshoppers hatch, farmers must poison them as soon as possible after hatching. Poison baits or sprays are frequently used.

Scientific classification. Locusts belong to the family Acrididae. Betty Lane Faber

See also **Grasshopper**; **Plant** (picture: Insects damage large numbers of plants).

Lodestone, also spelled *loadstone,* is a hard black rock that exhibits magnetic properties. It is made of the mineral magnetite.

According to an ancient Greek legend, lodestone was discovered by a shepherd who noticed that the iron nails in his boots and the iron tip of his staff clung to the rock over which he was walking. The earliest record of production of lodestone is from an ancient region in Asia Minor called *Magnesia.* The earliest recorded name for the rock is *Heraclean stone.*

About A.D. 1200, Europeans discovered that an oblong piece of this stone would point to the north and south if it were hung by a string. They called it a "leading stone," or *lodestone.* Lodestone made compasses possible, and sailors no longer had to steer by the stars. Today, the most powerful lodestones are found in Siberia, the Island of Elba, and South Africa.

Kenneth J. De Nault

See also **Magnetism** (Early discoveries).

Lodge, Henry Cabot (1850-1924), led Republican members of the Senate in a successful fight to keep the United States from joining the League of Nations after World War I. He opposed President Woodrow Wilson, the chief planner of the League. Lodge, who was chairman of the Senate Foreign Relations Committee, fought the League because he felt it would involve the United States too deeply in European affairs.

Lodge came from a wealthy Boston family. He graduated from Harvard University and served from 1873 to 1876 as an editor of an influential magazine, *North American Review.* He was a noted historian before being elected to the United States House of Representatives in 1886. As a Republican senator from 1893 until his death, Lodge pioneered in civil service law and helped draft the federal Food and Drugs Act of 1906.

William J. Eaton

Lodge, Henry Cabot, Jr. (1902-1985), served as a diplomat under four United States Presidents. In 1960, he was the vice presidential running mate of Richard M. Nixon on the Republican ticket.

Lodge was born in Nahant, Mass. He became a newspaperman following his graduation from Harvard University in 1924. He served in the Massachusetts legislature from 1933 to 1937 and won election to the U.S. Senate in 1936. He served there until 1944, when he resigned to enlist in the Army during World War II. He was reelected to the Senate in 1946.

In 1952, Lodge managed Dwight D. Eisenhower's presidential campaign. Eisenhower won, but Lodge lost his Senate seat to a young Democrat, John F. Kennedy. Under Eisenhower, Lodge served as United States ambassador to the United Nations. Nixon and Lodge lost the 1960 presidential election to Kennedy and Lyndon B. Johnson.

In 1963, President Kennedy appointed Lodge ambassador to South Vietnam. Lodge served 11 months. He held the same post from 1965 to 1967 under President Johnson.

Lodge became ambassador to West Germany in 1968. He resigned in 1969 to become President Nixon's chief negotiator at the Vietnam peace talks in Paris. He served as U.S. envoy to the Vatican from 1970 until 1977. Lodge then retired from public office. William J. Eaton

Lodge, Sir Oliver Joseph (1851-1940), an English physicist, investigated the nature of oscillations and electric waves in wires and in wireless telegraphy. His discoveries helped in developing the radio. His works include *Modern Views of Electricity* (1889), *Electrons* (1907), and *The Ether of Space* (1909). He served as professor of physics at University College, Liverpool. Later, he became deeply interested in spiritualism. Lodge was born on June 12, 1851, in Penkhull, England.
Richard G. Olson

Łódź, *looj* or *lahdz* (pop. 844,900), is the second largest city in Poland. Only Warsaw is larger. Łódź, which is also pronounced *wooj* in Polish, is the capital of the province of Łódź in central Poland (see **Poland** [political map]).

Łódź ranks as Poland's leading manufacturer of cotton cloth and other textiles. It also produces chemicals, electric appliances, machinery, and processed foods. The city is the center of Poland's motion-picture industry and the home of the University of Łódź.

Łódź received a city charter in the early 1400's. It expanded rapidly when its textile industry developed during the 1800's. During World War II (1939-1945), German troops occupied Łódź, and it was severely damaged. The city was rebuilt after the war. Janusz Bagajski

Loeb, *LOHB,* **Jacques,** *zhahk* (1859-1924), an American physiologist, made important studies of the chemistry and physics underlying the activities of living organisms. He proved that eggs can be made to develop by artificial means. In his opinion, all aspects of life can be explained in terms of physical and chemical processes. His works include *The Dynamics of Living Matter* (1906), *The Mechanistic Conception of Life* (1912), and *Regeneration* (1924).

Loeb was born on April 7, 1859, in Mayen, Germany. He came to the United States in 1891. He taught at Bryn Mawr College and at the universities of Chicago and California. In 1910, he joined the Rockefeller Institute for Medical Research (now Rockefeller University).
Daniel J. Kevles

Loess, *LOH ihs* or *lehs,* is a kind of silt that forms a fertile topsoil in some parts of the world. Loess consists of tiny mineral particles brought by wind to the places where they now lie. These mineral particles are finer than sand but coarser than clay. Topsoils that are made up of loess are found in the central and northwestern parts of the United States, in central and eastern Europe, in central Asia and east-central China, and in Argentina.

Two great sources have provided most of the world's loess. One source is the area that once bordered the great sheets of ice of the Pleistocene Epoch, a time marked by a succession of ice ages (see **Ice age**). These lands were dry and barren, so winds easily blew the soil to the grasslands farther south. The other great source is the vast deserts of central Asia. These deserts provided the loess now in eastern China. Taylor J. Johnson

Loesser, *LEH sehr,* **Frank** (1910-1969), an American composer, wrote the music and lyrics for many musical comedies and films. He won the 1949 Academy Award for his song "Baby, It's Cold Outside." Loesser and playwright Abe Burrows shared the 1962 Pulitzer Prize for drama for the musical comedy *How to Succeed in Business Without Really Trying* (1961).

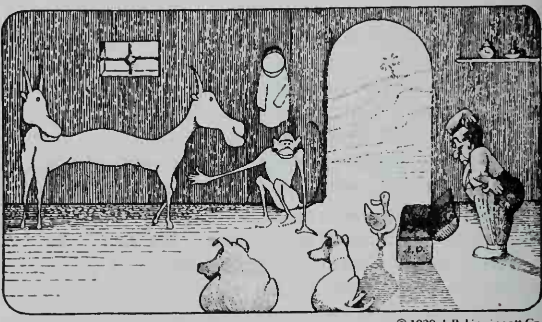
Loesser, whose full name was Francis Henry Loesser, was born on June 29, 1910, in New York City. In 1936, he moved to Hollywood, where he wrote lyrics for motion-picture musicals. He wrote the lyrics for several hit songs, including "Two Sleepy People" and "I Don't Want to Walk Without You." In the 1940's, he composed music and lyrics. Loesser wrote such songs as "On a Slow Boat to China" and "Spring Will Be a Little Late This Year."

Loesser was among the most versatile of Broadway songwriters. He attempted to explore a different style of musical with each of his shows. Loesser's first successful musical was *Where's Charley?* (1948). His next show, *Guys and Dolls* (1950), ranks among the finest musicals in history. Loesser wrote the story as well as the music and lyrics for *The Most Happy Fella* (1956). Ken Bloom

Löffler, *LUF luhr,* **Friedrich August Johannes,** *FREE drihk OW goost yoh HAH nuhs,* (1852-1915), a German bacteriologist, identified the diphtheria bacillus in 1884, with the help of bacteriologist Edwin Krebs. Löffler found a way to cultivate diphtheria bacteria, and he perfected a method of staining them so that they could be more easily observed under a microscope. He also developed a staining technique to demonstrate flagella, the whiplike structures that propel some bacteria. In 1898, Löffler and bacteriologist Paul Frosch became the first scientists to identify a virus as a cause of disease in animals. The virus they identified causes foot-and-mouth disease in cattle. Löffler was born on June 24, 1852, in Frankfurt (an der Oder), Germany. Kenneth R. Manning

Lofting, Hugh (1886-1947), was the creator of Doctor Dolittle, a well-known character in children's fiction. Lofting first wrote about the doctor in letters to his children during World War I, when he served in the British Army. When *The Story of Doctor Dolittle* was published in 1920, it was so popular that Lofting continued the adventures of Doctor Dolittle and his animal friends in *The Voyages of Doctor Dolittle* (1922). He received the Newbery Medal for this book in 1923. Lofting later wrote and illustrated 11 more Doctor Dolittle books.

Lofting was born on Jan. 14, 1886, in Maidenhead, England, of Irish descent. He spent most of his life in the United States. He studied at the Massachusetts Institute of Technology and at the London Polytechnic, and traveled widely as a civil engineer. Jill P. May



© 1920, J. B. Lippincott Co.

Dr. Dolittle is puzzled by the two-headed beast called the pushmi-pullyu. Dolittle's animal friends look on. They are Chee-Chee the monkey, Dab-Dab the duck, Jip the dog, and Gub-Gub the pig. Hugh Lofting, the author, also illustrated the story.

Log is an instrument that measures the speed of a ship. Logs used by modern ships include (1) a tachometer; (2) the Doppler sonar speed log; (3) the pitot-static log; and (4) electronic navigation devices.

A tachometer can be used for determining the revolutions per minute (rpm) of a ship's propeller. The speed of the ship often is directly related to the propeller's rpm. Therefore, a person can use the rpm to calculate the ship's speed. However, the accuracy of this method is greatly affected by weather, by the weight of the ship's load, or by the build-up of seaweed or small shellfish called *barnacles* on the ship's underside.

On yachts and smaller ships, a device called a *knotmeter* is often used to measure speed. The knotmeter determines the distance traveled by the ship by counting the revolutions of a small paddle wheel mounted on the ship's hull. The speed of the ship can be found by dividing the distance by the amount of time traveled.

The Doppler sonar speed log measures the apparent change in frequency of sound waves transmitted from a ship and then reflected from the bottom of the ocean. This change in frequency, or *Doppler effect,* is caused by the motion of the ship. See **Doppler effect**.

The pitot-static log operates by the action of water pressure. The basic part of a pitot-static log is a *pitot tube,* which is mounted below the bottom of the ship. The pitot tube has an opening on the side facing the front of the ship. Another tube surrounding the pitot tube has openings that face the sides of the ship.

When the ship is at rest, the water pressure at the openings of the pitot tube and surrounding tube is the same. This is known as *static* pressure. As the ship moves, its speed increases the water pressure on the opening of the pitot tube. This additional pressure is known as *dynamic* pressure. But the openings in the outer tube still receive only static pressure. Devices inside the ship measure the differences in pressure between the tubes to determine speed and distance.

Electronic navigation devices record the course and speed of a ship relative to stationary signal transmitters. For example, *loran* involves the transmission of radio signals from two stations, known as the *master* and *slave* stations, to a ship at sea. Receiver equipment on the ship measures the time interval between the signals from the two stations. The time difference places the ship on a *loran line of position* on a chart. The ship's exact location on this line can be established by using a second loran line of position. This line is determined by measuring the time difference between signals from the master station and a second slave station. The second line will intersect the first, thereby marking the ship's location. The ship's speed can be determined by taking two readings of the ship's position, with a known interval of time between the readings. See **Navigation** (diagram: Loran).

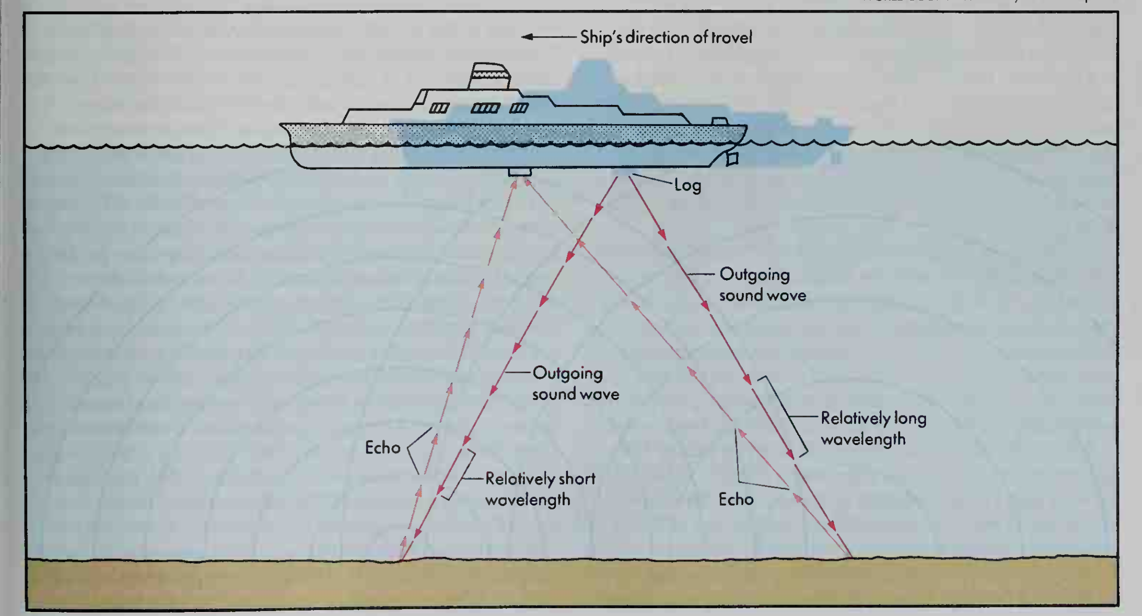
Logs used in the past included the *chip log* and the *taffrail log.* A chip log was a thin board shaped like a quarter of a circle. A sailor threw the log into the water behind the ship, and a line attached to it unreeled as the ship moved. By noting the amount of line that ran out in a given time, a sailor could determine the ship's speed. The taffrail log consisted of a rotator with spiral fins that caused it to turn as the ship pulled it through water. The rotator was connected to a recording device that showed the distance traveled. A sailor needed to make two readings, with a known interval of time between them, to obtain the speed of the ship. Robert F. Beck

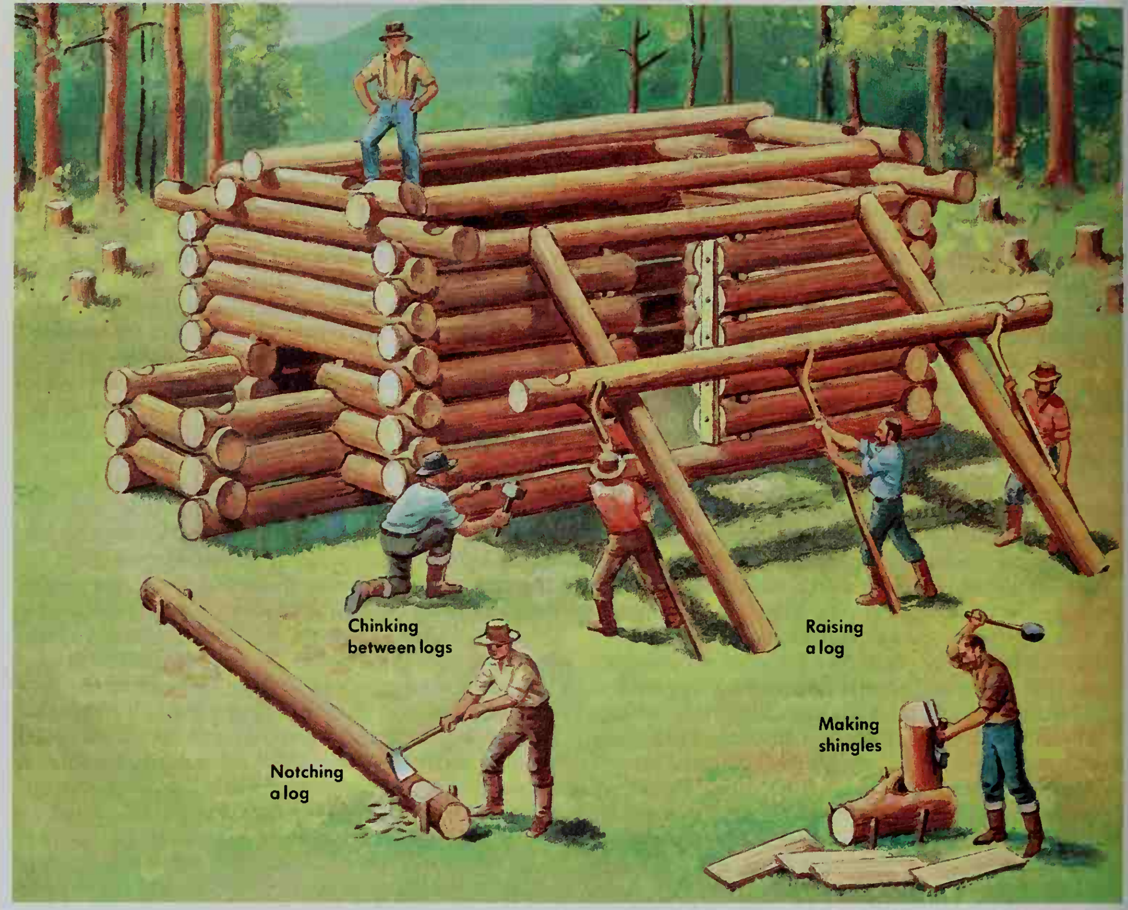
See also **Knot; Loran.**

The Doppler log

The Doppler sonar speed log measures echoes to determine a ship's speed. Sound waves traveling in the ship's direction of motion have shorter wavelengths and therefore higher frequencies than do oppositely moving waves. The difference in wavelength depends on the speed.

WORLD BOOK illustration by Brenda Tropinski





WORLD BOOK illustration by Gonzalez Vicente, S. I. International

American pioneers built log cabins entirely from materials available in the wilderness. The pioneers used these shelters until more permanent building materials became available.

Log cabin was one of the earliest dwellings built by European settlers in North America. Log cabins served as a practical form of shelter for people who settled in forest regions and who had few tools. The log cabin became a symbol of the hardships and virtues of frontier life. Many noted Americans, including five Presidents—Andrew Jackson, James Polk, James Buchanan, Abraham Lincoln, and James Garfield—proudly claimed being born in such dwellings.

The simplest log cabins were built of round logs with curved notches cut near the ends. Logs on the ground served as a foundation. Above the foundation, each log lay across the logs immediately below it and rested in their notches. In most cases, spaces between the logs were filled with stones or slats of wood and daubed tight with mud in a process called *chinking.* The roof was usually made of rough boards cut from logs.

People in Europe had been building log cabins for hundreds of years before Europeans came to America. Swedes and Finns made the first log cabins constructed in the New World. They built them beginning in about 1638 in the region near the mouth of the Delaware River. This area covered parts of what are now Delaware, New Jersey, and Pennsylvania. Log cabin construction spread to many other groups of colonists, including English, Scotch-Irish, Welsh, and Dutch settlers. Eventually, log cabin construction spread to most of the wooded American frontier. In Pennsylvania in the 1700's, German-speaking colonists from Switzerland and eastern Germany made popular a more refined log carpentry. They used shaped logs and special *dovetailed* notches.

Other groups of settlers built log cabins in many parts of North America. Various types of log cabins were introduced by Russians in Alaska, French farmers in Quebec, French-Canadian fur traders in western North America, Ukrainians in the Canadian Prairie Provinces, Spaniards and Mexicans in highland areas of New Mexico, and Finns in the northern Midwest. Terry G. Jordan

See also **Pioneer life in America** (A pioneer settlement); **Colonial life in America** (Houses); **Buchanan, James** (picture); **Kentucky** (picture: Fort Boonesborough State Park).

Logan (1725?-1786?), a Cayuga Indian chief, won fame for a stirring speech in 1774. White settlers along the Ohio River had murdered some Indians, including several of Logan's relatives. In revenge, Logan waged war against the settlements. His speech explained his actions to John Gibson, a soldier who tried to persuade

Logan to attend peace talks. Logan said that he had treated the white man as his brother, but the white man responded by murdering his relatives. This speech was praised by Thomas Jefferson. Logan's Indian name was Tahgahjute. His father was Shickellamy, a famous mixed-blood Cayuga leader. Logan was born in the Indian settlement of Shamokin, Pa. Robert E. Powless

Logan, John Alexander (1826-1886), gained fame as a Union general and political leader. After the Civil War, he helped organize the Grand Army of the Republic, a veterans' organization. Logan is also credited with naming May 30, 1868, as the first Memorial Day.

In 1862, Logan became brigadier general of volunteers and fought in all the Western campaigns under General Ulysses S. Grant. He later distinguished himself at the siege of Vicksburg, Miss., and served with General William T. Sherman on the march through Georgia. Logan became a major general of volunteers and a corps commander. His soldiers called him *Black Jack* because of his dark complexion, eyes, and hair.

Logan represented Illinois in the U.S. House of Representatives from 1859 until 1861, when he resigned to recruit an Illinois regiment and become its colonel. He returned to the House in 1867. He was a U.S. senator from Illinois from 1871 to 1877 and from 1879 until his death. He ran unsuccessfully for Vice President on the Republican ticket with James G. Blaine in 1884.

Logan was born in Jackson County, Ill. He studied law at the University of Louisville and was admitted to the bar. He was a volunteer in the Mexican War, then served in the 1853 and 1857 sessions of the Illinois legislature.
James E. Sefton

Logan, Joshua (1908-1988), was an American director and dramatist. He became best known as the coauthor and director of the musical *South Pacific* (1949). He shared a 1950 Pulitzer Prize for drama with Oscar Hammerstein II and Richard Rodgers for *South Pacific.* Logan was also coauthor and director of the popular play *Mister Roberts* (1948). In addition, he directed the musicals *Knickerbocker Holiday* (1938), *Annie Get Your Gun* (1946), and *Fanny* (1954), and the play *Picnic* (1953). He also directed several motion pictures. Logan wrote two volumes of autobiography—*Josh: My Up and Down, In and Out Life* (1976) and *Movie Stars, Real People and Me* (1978). He was born in Texarkana, Tex.
Daniel J. Watermeier

Logan, Mount. See Mount Logan.

Logan, Sir William Edmond (1798-1875), a Canadian geologist, gained fame for his pioneer work researching coal, glacial action, early fossil evidence of life, and ancient rocks. Logan was born in Montreal and educated in Scotland. During much of the 1830's, he studied coal deposits in Wales. He then returned to Canada to continue his research. In 1842, Logan became the first director of the Geological Survey of Canada. His most important book was *A Report on the Geology of Canada* (1863). Dennis R. Dean

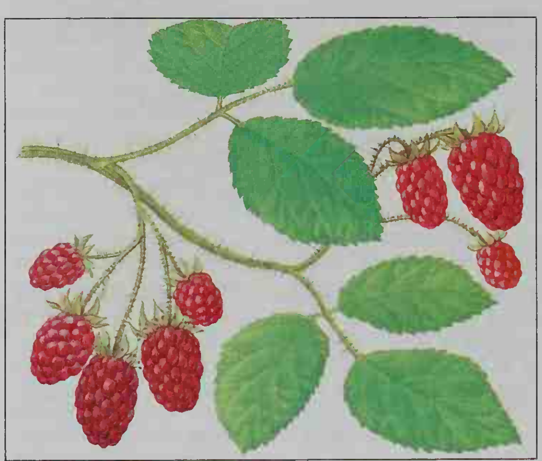
Logan Act is a United States law that prohibits private citizens from opening negotiations with a foreign government on a dispute between that government and the United States. Congress passed the law in 1799 in reaction to the activities of George Logan, a Philadelphia Quaker. Logan had gone to Paris in 1798 to try to end a naval dispute that had led to many battles between American and French sailors. Logan did no harm, but President John Adams warned Congress that Logan could have confused and harmed the negotiations then going on. Adams said that individuals should not interfere with official diplomatic relations between nations.

Punishment for violation of the Logan Act may include up to three years in prison and a fine of up to $5,000. A number of private citizens have held controversial meetings with foreign governments through the years, but there is no evidence that anyone has ever been convicted of violating the Logan Act. Jerald A. Combs

Loganberry is a small, reddish-purple fruit that grows on a trailing blackberry plant. Each loganberry consists of a cluster of tiny fruits called *drupelets.* The loganberry is probably a natural hybrid of a red raspberry and a type of blackberry called the *western dewberry.* Unlike other blackberries, which grow on erect bushes, loganberries and other dewberries develop on long, willowy *brambles* (see **Bramble**). Loganberries usually are not eaten fresh because of their extremely tart flavor. Instead, they are canned or frozen, or are made into jam, jelly, juice, or wine.

Loganberries are grown commercially in the Pacific Coast States and southwestern British Columbia. The plants grow best in fertile, well-drained, deep soil at temperatures above 14 °F (−10 °C). They need to be irrigated for their fruits and stems to develop properly.

Growers produce loganberry plants by burying parts of stems or roots in mounds of earth. As the plants grow, they are tied to stakes or wire frames. After the fruit is picked, growers remove the old stems to make room for new stems to develop. The plants produce fruit annually until they are about 12 years old.



WORLD BOOK illustration by Stuart Lafford, Linden Artists Ltd.

Loganberries consist of clusters of tiny fruits called *drupelets.* The berries grow on trailing vines.

Scientific classification. The loganberry plant belongs to the rose family, Rosaceae. Its scientific name is *Rubus loganobaccus.* George W. Eaton

See also **Blackberry; Dewberry.**

Logarithms, *LAWG uh rihth uhmz,* are numbers that are known in algebra as *exponents.* Exponents are used to express repeated multiplications of a single number. For example, $2 \times 2 \times 2$ can be written 2^3. In the

equation $2^3 = 8$, 3 is the *exponent* and 2 is the *base.* Stated in terms of logarithms, 3 is the *logarithm* of the number 8 to the base 2. This statement can be written as $\log_2 8 = 3$. The equation $\log_2 8 = 3$ is another way of expressing $2^3 = 8$. In general, if $b^x = p$, then $x = \log_b p$.

Suppose you want to calculate the number of ancestors you have in each of three previous generations. You have 2 parents, so you have 2 ancestors in the first generation. This calculation can be expressed as $2^1 = 2$. Each of your parents has 2 parents, so you have $2 \times 2 = 2^2 = 4$ ancestors in the second generation. Each of your grandparents has 2 parents, so you have $4 \times 2 = 2 \times 2 \times 2 = 2^3 = 8$ ancestors in the third generation. The calculation continues in this pattern. In which generation do you have 1,024 ancestors? That is, for which exponent x is it true that $2^x = 1{,}024$? You can find the answer by multiplying 2 by itself until you reach 1,024. But if you know that $\log_2 1{,}024 = 10$, you know the answer is 10.

The laws of logarithms

Because logarithms are exponents, the properties of exponents apply to them. The following equations show some of the important properties of exponents:

(1) $3^2 \times 3^3 = 3 \times 3 \times 3 \times 3 \times 3 = 3^5$, so $3^2 \times 3^3 = 3^{2+3}$. Thus, $b^x \times b^y = b^{x+y}$.

(2) $3^5 \div 3^2 = (3 \times 3 \times 3 \times 3 \times 3) \div (3 \times 3) = 3^3$, so $3^5 \div 3^2 = 3^{5-2}$. Thus, $b^x \div b^y = b^{x-y}$.

(3) $(2^3)^2 = 2^3 \times 2^3 = 2^{3+3} = 2^6$, so $(2^3)^2 = 2^{3\times 2}$. Thus, $(b^x)^y = b^{xy}$.

(4) $(25^{\frac{1}{2}})^2 = 25^{\frac{1}{2}\times 2} = 25^1 = 25$, so $25^{\frac{1}{2}} = \sqrt[2]{25} = 5$. Thus, if n is a positive whole number, $b^{\frac{1}{n}} = \sqrt[n]{b}$.

These properties of exponents can be restated as properties of logarithms:

(1) $\log_b(p \times q) = \log_b p + \log_b q$

(2) $\log_b(p \div q) = \log_b p - \log_b q$

(3) $\log_b(p^n) = n \log_b p$.

(4) $\log_b(\sqrt[n]{p}) = \frac{1}{n} \log_b p$.

To show that the first property is true, let $\log_b p = x$ and $\log_b q = y$. Then $p = b^x$ and $q = b^y$. So $p \times q = b^x \times b^y$ and $p \times q = b^{x+y}$. Since $p \times q = b^{x+y}$, $\log_b(p \times q) = x + y$. Therefore, $\log_b(p \times q) = \log_b p + \log_b q$. The other three properties can be derived in a similar way.

Using logarithms

Multiplication. To multiply two numbers using logarithms, look up the logarithms of the two numbers in a table. Add these logarithms to get the logarithm of the product of the two numbers. Then, using the table again, find the number whose logarithm is the logarithm of the product. This is the product of the two numbers.

Division. To divide one number by another, look up the logarithms of the two numbers in a table. Subtract the logarithm of the denominator from the logarithm of the numerator. Then, using the table again, find the number whose logarithm is the same as the logarithm found by this subtraction. This number is the desired quotient.

Raising a number to a power. To raise a number to a power, look up the logarithm of the number in a table. Multiply this logarithm by the exponent of the power. Then, using the table again, find the number whose logarithm is the same as the logarithm found by this multiplication. This number is the desired power of the first number.

Finding a root. To find a root of a number, look up the logarithm of the number in a table, and divide this logarithm by the index of the root. Then, using the table again, find the number whose logarithm equals the number found by the division. This is the desired root of the number. See **Root; Square root**.

Kinds of logarithms

Common logarithms. Any positive number, other than 1, can serve as a base for logarithms. However, 10 is the most convenient base because the most common number system is based on 10. Logarithms to the base 10 are called *common* logarithms.

The common logarithms of two numbers that have the same sequence of digits, such as 247 and 2.47, differ only by an *integer,* or whole number. For example, $247 = 100 \times 2.47 = 10^2 \times 2.47$. Therefore, $\log_{10} 247 = \log_{10} 10^2 + \log_{10} 2.47 = 2 + \log_{10} 2.47$. Thus, the common logarithms of 247 and 2.47 differ only by the whole number 2. In fact, to four decimal places, the common logarithm of 247 is 2.3927 and that of 2.47 is 0.3927.

Because 247 lies between 100 and 1,000, that is between 10^2 and 10^3, $\log_{10} 247$ lies between $\log_{10} 10^2$ and $\log_{10} 10^3$. That is, the common logarithm of 247 lies somewhere between 2 and 3. Thus, the whole number part of $\log_{10} 247$, or of any other common logarithm, can be determined mentally.

In common logarithms, the whole number part is called the *characteristic,* and the decimal part is called the *mantissa.* For a given sequence of digits, a shift in the position of the decimal point changes the characteristic, but not the mantissa. Because the characteristic can be determined mentally, tables of common logarithms list only mantissas.

Natural logarithms. Mathematicians and scientists use *natural* logarithms in their work. In the system of natural logarithms, the base is the number $e = 2 + \frac{1}{2} + \frac{1}{2\times 3} + \frac{1}{2\times 3\times 4} + \ldots = 2.71828\ldots$. Natural logarithms are useful in calculus because many important formulas take their simplest possible forms using them.

History

John Napier, a Scottish mathematician, published the first discussion and table of logarithms in 1614 (see **Napier, John**). Jobst Bürgi of Switzerland independently discovered logarithms at about the same time. In the early 1600's, Henry Briggs of England introduced logarithms to the base 10 and began constructing a 14-place table of common logarithms. Adriaen Vlacq of the Netherlands completed Briggs's work.

The Briggs-Vlacq tables remained in use until 20-place common logarithm tables were calculated in Britain between 1924 and 1949. Today, computers and electronic calculators have eliminated the need to use logarithms for computation. However, logarithms continue to be important for theoretical purposes.

Thomas J. Brieske

Logbook is the official or legal written record of the events that take place during a ship's voyage. The log may be written up once a day by the captain of the ship, or it may be written by the officer in charge of each watch. It includes a record of the ship's course and speed, the weather, and any ships or lands sighted. It also includes mention of any sickness, death, or crime on board ship, and of any other unusual event. See also **Log**. Joseph A. Gutierrez, Jr.

Logging. See **Lumber** (From forest to sawmill).

Logic is a branch of philosophy that deals with the rules of correct reasoning. Most work in the field of logic deals with a form of reasoning called an *argument.* An argument consists of a set of statements called *premises,* followed by another statement called the *conclusion.* If the premises support the conclusion, the argument is correct. If the premises do not support the conclusion, the argument is incorrect.

There are two types of arguments, *deductive* and *inductive.* A deductive argument is *valid* when the conclusion must be true if the premises are true. When the conclusion does not necessarily follow from the premises, a deductive argument is *invalid.* In an inductive argument, the conclusion is more or less probably true on the basis of the premises. Because the conclusion does not follow necessarily from the premises, an inductive argument is not usually deductively valid. An inductive argument may be correct or incorrect. This article deals mainly with deductive reasoning. For more information on inductive reasoning, see **Inductive method.**

Logic tells us whether a deductive argument is valid or invalid. The validity of such an argument depends on the form of the argument, not on the truth of its premises. As a result, an argument that depends on false premises could be valid, and an argument based on true premises could be invalid.

The categorical syllogism is the most common form of argument in traditional deductive logic. The ancient Greek philosopher Aristotle was one of the first scholars to carry out a systematic study of the categorical syllogism.

A syllogism consists of two premises and a conclusion. A categorical syllogism is one in which every statement has one of the four forms: (1) All A are B. (2) No A are B. (3) Some A are B. (4) Some A are not B. The letters A and B, or any other letters that might be used, are terms that represent various classes of things, such as numbers, people, yellow objects, unpleasant sounds, or brown cows. The following argument is an example of a valid categorical syllogism: "All mammals are warm-blooded. All brown cows are mammals. Therefore, all brown cows are warm-blooded." The form of this syllogism is: "All A are B. All C are A. Therefore, all C are B."

The following categorical syllogism is invalid: "No stars are planets. Some satellites are not planets. Therefore, some satellites are not stars." This syllogism has the following form: "No A are B. Some C are not B. Therefore, some C are not A." We can determine that this syllogism is invalid by comparing it with another syllogism that has the same form and yields a false conclusion. Such a syllogism would be: "No precious stones are cheap things (true). Some diamonds are not cheap things (true). Therefore, some diamonds are not precious stones (false)." This syllogism fails to meet the requirement that the conclusion must be true if the premises are true. Therefore, the syllogism must be invalid.

The rules of syllogisms enable us to test a categorical syllogism without considering similar examples or examining the argument's structure in detail. These rules are based on certain features that occur in all valid syllogisms and distinguish them from invalid ones. For example, one rule states that no valid syllogism has two negative premises. There are two negative premises in this syllogism: "*No* stars are planets. Some satellites are *not* planets. Therefore, some satellites are not stars." Thus, we know that this syllogism cannot be valid.

There are other rules for constructing valid syllogisms. (1) The syllogism must have exactly three terms. For example, consider this invalid syllogism: "All laws are made by Congress. $v=at$ is a law of falling bodies. Therefore, Congress made $v=at$." The term *law* is unclear. It can refer to a physical law, such as the law of falling bodies, or to legislative law. As a result, this syllogism has four terms instead of three—and is invalid. (2) Two positive premises must yield a positive conclusion. (3) A negative premise and a positive premise must yield a negative conclusion. (4) The term that occurs in both premises must be modified by the words *all* or *none* at least once. (5) A term that is modified by *all* or *none* in the conclusion must be modified by *all* or *none* in one of the premises.

Modern logic extends far beyond the work of Aristotle. Modern *logicians* (scholars who study logic) have developed theories and techniques to deal with deductive arguments other than categorical syllogisms. Notable modern logicians include the British mathematicians George Boole and Alfred North Whitehead and the British philosopher Bertrand Russell. These logicians, unlike traditional ones, have used mathematical methods, as well as techniques that involve symbols.

Today, logic is used mainly to test the validity of arguments. It also has important uses in working with such devices as computers and electric switching circuits.

To test an argument, a logician first analyzes its statements and expresses them as symbols. In many cases, a letter or other character in an argument stands for a whole word or phrase. For example, logicians would write the sentence "Socrates is wise" as "Ws." The sentence "Every Greek is wise" would be written as a formula: "(x) (Gx → Wx)." The → means *if ______, then* ______. Next, the logician uses *rules of derivation,* also called *inference rules,* to determine what new formulas may be derived from the original premises. For example, one rule enables the statement "Q" to be derived from the statements "P" and "(P → Q)." Thus, the statement "The picnic is canceled" may be derived from "It is raining" and "If it is raining, then the picnic is canceled." The logician continues to derive formulas until a conclusion has been reached.

Special uses of logic. Special branches of logic guide much reasoning in science, law, and certain other fields. Various branches of logic guide reasoning involved in obligations, promises, commands, questions, preferences, and beliefs.

Much of the reasoning that people do in everyday life is nondeductive—that is, it produces probable conclusions rather than definite ones. For example, physicians use nondeductive reasoning in diagnosing the probable

cause of a patient's symptoms. Legal scholars often use nondeductive methods to determine what law governs a particular case. Morton L. Schagrin

Related articles in *World Book* include:

Aristotle
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Fallacy
Geometry (Geometry as a logical system)
Russell, Bertrand
Science (Mathematics and logic; Using logic)
Set theory (In logic)
Truth table
Whitehead, Alfred North

Additional resources

Copi, Irving M., and Cohen, Carl. *Introduction to Logic.* 11th ed. Prenctice Hall, 2002.
Haight, M. R. *The Snake and the Fox: An Introduction to Logic.* Routledge, 1999.
Jacquette, Dale. *Symbolic Logic.* Wadsworth Pub., 2001.

Logistics, *loh JIHS tihks,* is the practical art of providing and maintaining soldiers, equipment, and supplies for military operations. Modern armies armed with complex weapons and equipment require tremendous logistical effort to put them into battle and keep them there. For example, almost half the total strength of the United States Army in World War II (1939-1945) had to provide logistic support for the other half that came in direct contact with the enemy. One out of four men in a combat division performed duties related to logistics, such as supply and administration.

The extraordinary task of supplying an army can be imagined by comparing the amounts of artillery ammunition fired in World War I (1914-1918) and in the American Civil War (1861-1865). During one average month of World War I, the British and French armies fired more than twice as much artillery ammunition as did the Union Army during the entire Civil War.

Supply forms only one part of the task of logistics. Military forces must be moved from place to place. They must have lodging, food, and medical care. Records on the fighting forces must be kept.

On land and in the air, chemical, engineer, medical, ordnance, quartermaster, signal, and transportation units provide logistic support for combat units. At sea, cargo ships, hospital ships, icebreakers, minelayers, oilers, repair ships, transports, and tugs provide this support to warships. Joel D. Meyerson

Logrolling. See **Birling.**

Logrolling is the trading of votes as commonly practiced in legislative bodies. One party or group in a legislature may want to pass a bill in which it is vitally interested. Another party or group may want to pass a different bill. Each group may have little or no interest in the other's project. But each group votes for the other's bill in order to obtain support for its own bill. For this reason, "You scratch my back and I'll scratch yours" is the common description of logrolling. A common case of logrolling arises in connection with approving appropriations for local projects. Peter Woll

Logwood comes from the core of a tree belonging to the pea family. The tree grows in tropical regions of Central America, Mexico, South America, and the West Indies. Its heartwood is bright orange. When exposed to air, however, it changes to red and finally reddish-black. The wood is very hard and heavy. It is called *logwood* because it is shipped to market in log form.

Logwood is used mainly to make dyes, stains, and manufacturing inks. By boiling logwood chips in water, workers extract a substance called *hematoxylin.* This substance forms an orange-red solution with the water. Dyes that are also referred to as logwood can be turned lighter shades of red by adding acids. They can be produced in black or in darker shades of red, blue, or purple by adding alum and alkalis. The dyes are most commonly used on cotton, silk, and woolen goods.

Aldos C. Barefoot, Jr.

Scientific classification. Logwood belongs to the pea family, Fabaceae or Leguminosae. Its scientific name is *Haematoxylon campechianum L.*

Loire River, *lwahr,* is the longest river in France. It is about 650 miles (1,050 kilometers) long, and it drains about a fourth of the country. For location, see **France** (physical map). The Loire rises in the Velay Mountains, about 4,500 feet (1,370 meters) above sea level, and flows northward to Orléans. At Orléans, it turns westward and flows through the Loire Valley, which is known for its many *châteaux* (castles). It empties into the Bay of Biscay in western France. The river was an important navigable waterway in the past, but large, modern boats find it difficult to sail on the Loire because of occasional floods and many sandbanks. The wide mouth of the river at St.-Nazaire has been deepened by dredging from Nantes to the sea. Canals connect the Loire with the Saône, Rhône, and Seine rivers. The Loire's most important tributaries are the Allier, Cher, Indre, Maine, and Vienne rivers. The Romans called the Loire the *Liger.*

Hugh D. Clout

Loki, *LOH kee,* was a god of Norse mythology who was known as a troublemaker and trickster. He was the son of a giant but lived among the gods, who were the enemies of the giants. Most stories of Loki portray him as evil, though some myths tell of occasions when he helped the gods. Loki could change his shape at will, and he frequently would appear as an old woman or an animal.

The principal myth about Loki concerns his role in the murder of Balder, the handsome son of Odin, the chief god. Balder could be killed only by mistletoe, and so the gods made a sport of throwing things at him because he would not be hurt. One day, when the gods were amusing themselves in this way, Loki handed the blind god Hoder a sprig of mistletoe. Loki helped the unknowing Hoder aim the branch and throw it at Balder. The mistletoe pierced Balder's body and killed him.

When the gods learned what Loki had done, they sentenced him to be chained across three rocks, with a snake dripping poison onto his face. His wife, Sigyn, caught the drops of poison in a bowl. But each time the bowl filled up and she left to empty it, the venom struck Loki and made him twist in agony. According to the myths, Loki's trembling is the cause of earthquakes.

According to legend, Loki will remain chained until the time of a battle called *Ragnarok.* He will then break free and join the giants in an attack on the gods. The world will be destroyed in this battle, and all the gods and giants will die. Carl Lindahl

See also **Balder.**

Lollards, *LAHL uhrdz,* were followers of the English religious reformer John Wycliffe. Lollardism developed as a religious movement in the 1380's. The Lollards preached obedience to God, reliance on the Bible as a guide to Christian living, and simplicity of worship. They

rejected the richness of the Mass, most sacraments, and the supremacy of the pope. They denied that an organized church was necessary for salvation. Most Lollards were poor priests or people who were not members of the clergy. They wore long russet gowns, carried staffs, and lived on what they could beg. Henry IV of England, who became king in 1399, persecuted the Lollards because their views disagreed with religious law. But despite persecution, the movement gained many followers among the common people. The movement began to lose support after 1420.

The Lollards had little permanent effect on religious life in England, but they had great influence in Bohemia. There, John Hus was burned at the stake in 1415 for preaching Wycliffe's doctrines. One hundred years later, Martin Luther embraced some of Hus's ideas. In this way, the Lollards helped to pave the way for the Protestant Reformation. Peter W. Williams

See also **Wycliffe, John; Hus, John.**

Lombard, *LAHM bahrd,* **Peter** (1095?-1160), was a medieval theologian who wrote an important theological textbook, *The Four Books of Sentences.* It was completed by 1158, and served as a standard textbook in theological schools for 300 years.

In the *Sentences,* Lombard presented past and current opinions on theological problems in a systematic way. He compiled these opinions from a number of leading church authorities, especially Saint Augustine. Lombard also summarized the church's position and wrote his own views on the issues. For centuries, students of theology were required to comment on the *Sentences.* Some of these commentaries were the major works of leading medieval theologians and philosophers, including Saint Bonaventure, John Duns Scotus, and William of Ockham.

Lombard was born near Novara, Italy, and studied in Bologna. About 1134, he went to Paris and taught in the cathedral school of Notre Dame. Lombard quickly gained fame as a theologian and author. In 1159, he was appointed bishop of Paris. William J. Courtenay

See also **Scholasticism** (The scholastic method).

Lombardi, *lahm BAHR dee,* **Vince** (1913-1970), became one of the most successful coaches in National Football League (NFL) history. Lombardi served as head coach and general manager of the Green Bay Packers for nine seasons beginning in 1959. He remained as general manager of the Packers in 1968. Lombardi's Green Bay teams won 89 games, lost 29, and had 4 ties. They won five NFL championships. His teams won the first two Super Bowls, in 1967 and 1968. Lombardi was known for his philosophy of hard work, dedication, and team pride. He became identified with his motto, "Winning isn't everything; it's the only thing." In 1969, he became head coach, general manager, and part owner of the Washington Redskins of the NFL.

Vincent Thomas Lombardi was born in New York City. He played football at Fordham University from 1934 to 1936. He served as an assistant coach there in 1947 and 1948 and at the U.S. Military Academy from 1949 to 1954. He coached the offense for the New York Giants of the NFL from 1954 to 1959. Lombardi was voted into the Pro Football Hall of Fame in 1971. Carlton Stowers

Lombards, *LAHM bahrdz,* were members of a Germanic tribe that conquered much of Italy in the late A.D. 500's, and threatened the political power of the popes.

The Lombards probably came from Gotland Island in the Baltic Sea. They migrated to northern Germany along the lower Elbe River in the 100's B.C. In the A.D. 300's, they began to move southward. By about 490, they had settled in what is now Austria. The Lombards invaded Italy in 568 and seized control of much of the Italian peninsula. They settled in a part of northern Italy that is still called *Lombardy.*

The popes in Rome feared the Lombards would destroy their political power. In 754, Pope Stephen II asked the Franks for help. Pepin the Short, the Frankish king, invaded Italy and defeated the Lombards. Pepin gave part of central Italy to the pope in 756. In 774, Charlemagne, Pepin's son, crushed the Lombards. As a result, the Franks won control of Italy and the popes' power remained secure. William G. Sinnigen

Lombardy, *LAHM buhr dee,* is a region in northern Italy. It is named for the Lombards, a tribe that once lived there. Lombardy has a population of about 9 million and an area of 9,205 square miles (23,842 square kilometers). It includes the provinces of Bergamo, Brescia, Como, Cremona, Mantova, Milano, Pavia, Sondrio, and Varese. Peaks and valleys of the Alps extend across northern Lombardy. A fertile plain covers the southern part of the region. Lombardy is Italy's chief industrial region. It produces much cheese, silk, and wine. Milan is the capital. See also **Lombards; Milan.** David I. Kertzer

Lomé, *loh MAY* or *law MAY* (pop. 366,476), is the capital and largest city of Togo. It lies in southwest Togo on the Gulf of Guinea, an arm of the Atlantic Ocean. For location, see **Togo** (map). Lomé's port serves as the main outlet for Togo's cocoa, coffee, cotton, palm oil, and other products. In addition, Lomé is a popular tourist destination. Lomé has an international airport. Highways and railroads connect the city with major towns of Togo's coast and interior.

Lomé was a small village until 1897, when it became the capital of German Togo. In 1919, Lomé came under French control. Togo gained independence from France in 1960. Since then, Lomé has expanded its port, built new hotels, and become the site of Togo's only university. Mark W. DeLancey

Lomond, Loch. See **Loch Lomond.**

Lon Nol, *lahn nohl* (1913-1985), headed the government of Cambodia from 1970 to 1975. He and other Cambodian leaders overthrew Prince Norodom Sihanouk because they opposed his friendly policy toward Communists in Vietnam. Lon Nol declared Cambodia a republic but soon began to rule as a dictator. He suffered a stroke in 1971 and gave up many duties. But in 1972, he set up a new government with himself as president.

Cambodia became involved in the Vietnam War during the early 1970's. Cambodian government troops fought Communist rebels. Lon Nol fled to the United States in 1975, shortly before his government surrendered to the Communists. See **Cambodia** (History).

Lon Nol was born in Prey Veng Province in Cambodia when the country was a French colony. He joined the army in 1952, and Cambodia gained independence the next year. Lon Nol became a lieutenant general in 1961. He served as minister of defense from 1955 to 1966. He was prime minister from 1966 to 1967 and from 1969 to 1972. David P. Chandler



© David H. Endersbee, Tony Stone Images

Trafalgar Square in central London is one of the city's most popular sites. It is named for a famous naval battle of 1805 in which Admiral Horatio Nelson led the British fleet to victory. A statue of Nelson stands atop the tall column in the center of the square.

London

London is the capital of the United Kingdom of Great Britain and Northern Ireland, which is usually called simply the United Kingdom or Britain. London is the largest city in the United Kingdom and one of the largest cities in the world. It is the headquarters of the nation's government and a world center of culture, finance, tourism, and trade.

London is one of the world's oldest and most historic cities. It traces its beginnings to nearly 2,000 years ago. It grew up around two historic cities—the City of London and the City of Westminster. The City of London started as a trading post of the Roman Empire in A.D. 43. The City of Westminster began as a residence for England's rulers about 1,000 years later. The City of Westminster stood about 2 miles (3 kilometers) southwest of the City of London, which was surrounded by a great stone wall. As London grew, it spread far beyond its wall and took in the royal City of Westminster.

Today, the area where Roman London stood is still known as the City of London, often called simply *the City.* It and the City of Westminster lie at the heart of London and make up much of its lively center. Central London has tall office buildings and busy streets as well as outstanding museums, art galleries, theaters, and beautiful parks. Its famous landmarks include Buckingham Palace, the Houses of Parliament, and St. Paul's Cathedral with its huge dome. The rest of London extends about 10 to 19 miles (16 to 31 kilometers) in every direction from this central section.

Andrew Church, the contributor of this article, is University Lecturer of Geography at Birkbeck College, London University.

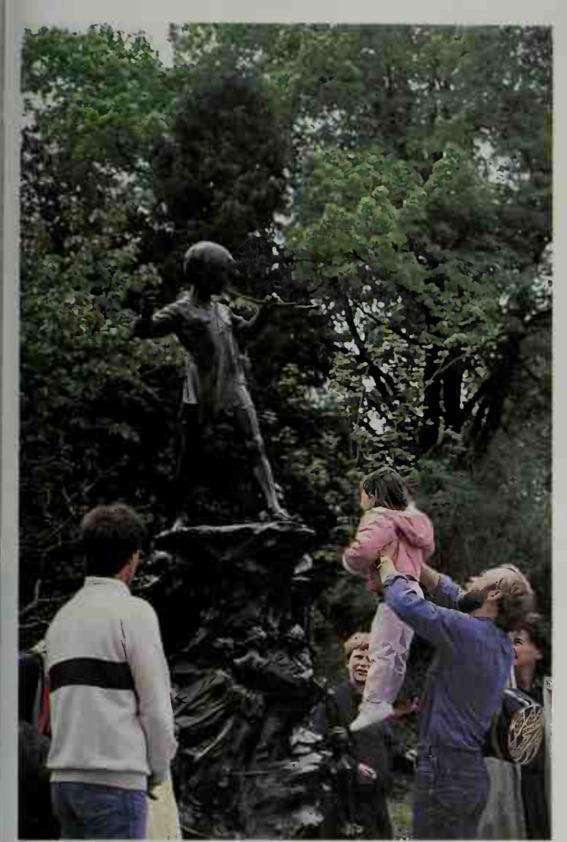
Greater London

The old City of London and the communities surrounding it form Greater London or simply London. London covers 614 square miles (1,590 square kilometers) in the southeastern part of England, one of the four political divisions that make up the United Kingdom.

The River Thames (pronounced *tehmz)* flows east through the heart of London. Near the river, the land ranges from low and flat to gently rolling. Away from the

Facts in brief

Population: *Greater London*—6,378,600.
Area: *Greater London*—614 mi^2 (1,590 km^2).
Climate: *Average temperature*—January, 42 °F (6 °C); July, 65 °F (18 °C). *Average annual precipitation* (rainfall, melted snow, and other forms of moisture)—21 in (53 cm).
Government: Thirty-two borough governments, each consisting mainly of elected councils and headed by a mayor; and the City of London government made up of the lord mayor, 24 aldermen, and at least 100 council members.
Founded: *City of London*—A.D. 43.



© Jane Lewis, Tony Stone Images

A statue of Peter Pan attracts visitors to Kensington Gardens, one of central London's five *royal parks.* The royal parks are owned by the British monarch but are set aside for public use.

river, the landscape becomes slightly hilly. About 40 miles (64 kilometers) east of London, the Thames empties into the North Sea, an arm of the Atlantic Ocean. The river thus links London with shipping routes throughout the world. From time to time in the past, London experienced flooding when high tides and severe storms raised the level of water in the North Sea and caused tidal surges in the Thames. The Thames Barrier, in east London, now provides protection against floods.

London is divided into 32 *boroughs* (local units of government) plus the City. Greater London, the City, and each of the boroughs have their own government.

Central London covers about 10 square miles (26 square kilometers) on both sides of a great north-south bend in the River Thames. It includes the busiest and best-known parts of London.

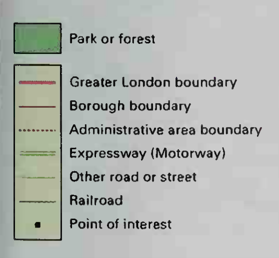
Central London can be divided into three main sections: (1) the City, (2) the West End, and (3) the South Bank. The City and the West End lie on the north side of the Thames. The South Bank lies across the river from these areas.

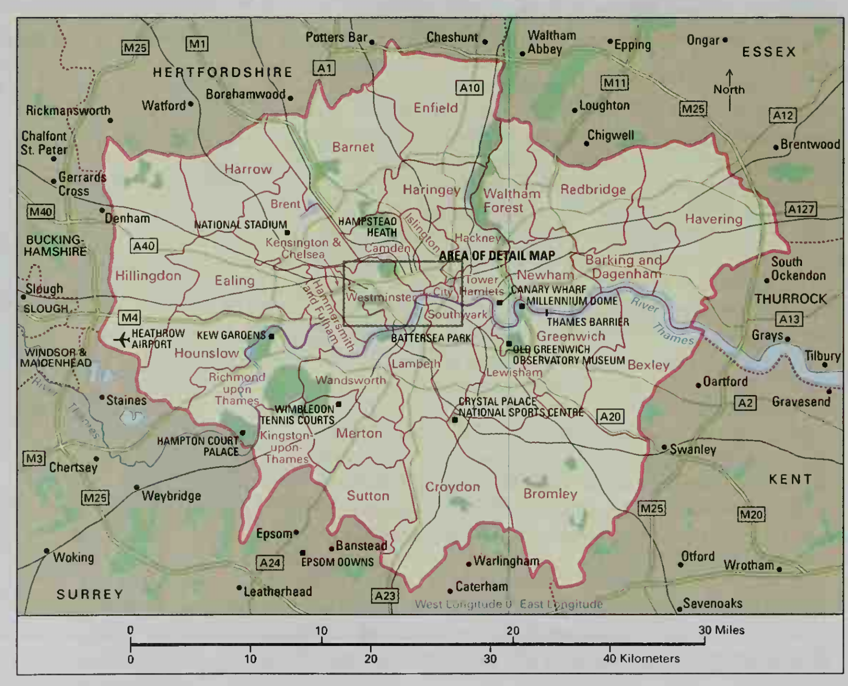
The City forms London's famous financial district. It covers about 1 square mile (2.6 square kilometers) at the eastern edge of central London. Only a few thousand people live in the City. But hundreds of thousands of office workers crowd its buildings and sidewalks on workdays.

The City is the oldest part of London. It stands where the walled City of London stood for hundreds of years. The City consists largely of modern office and bank buildings. But it also has some reminders of its colorful past. The great dome of St. Paul's Cathedral, for example, still towers over other buildings in the area, just as it has for hundreds of years. Parts of the Guildhall date from the 1400's. This building has long served as the City's administrative center. Mansion House dates from the mid-

Greater London







WORLD BOOK maps

1700's. It serves as the official residence of the lord mayor, the City's chief official. A 202-foot (62-meter) stone column called the Monument stands near the spot in the City where the Great Fire started in 1666.

The West End is the center of the United Kingdom's government and London's retail trade and night life. It is known for its many theaters. It also includes some exclusive residential areas. The West End covers about 8 square miles (21 square kilometers) just west of the City. Near the River Thames, a street called the Strand links the West End and the City. The Strand is one of London's oldest and busiest streets.

The United Kingdom's chief government buildings are in the City of Westminster, the oldest part of the West End. The Houses of Parliament, perhaps the best-known government buildings, tower dramatically along the Thames. From Parliament, the government buildings extend north along a broad avenue called Whitehall. 10 Downing Street, the traditional residence of the British prime minister, is just off Whitehall. Buckingham Palace, the London residence of the British monarch, lies a short distance to the southwest of Downing Street.

London's main shopping and entertainment districts spread out from two huge West End intersections. One intersection, Trafalgar Square, is an area of open pavement with statues and fountains. Whitehall, the Strand, and streets from the upper West End meet at the square. At the other intersection, Piccadilly Circus, six busy downtown streets come together. Many of London's finest shops are north and west of Piccadilly Circus, along Bond, Oxford, and Regent streets. Piccadilly Circus forms the center of London's largest entertainment area. The area extends east to the Strand and north into Soho, a district of restaurants and nightclubs.

The South Bank has many office buildings, and it is also the site of a large, modern cultural center that includes a number of theaters, concert halls, museums, and an art gallery. The South Bank covers about 2 square miles (5 square kilometers) along a curve of the River Thames.

The South Bank section grew more slowly than the City and the West End. Its development occurred as the cost of land in the City and the West End forced builders to find cheaper sites across the river.

Outlying areas. Crowded residential neighborhoods surround most of central London. Numerous small offices and factories and the workshops of a variety of designers are mixed in with the houses in many communities, especially in the area known as the East End. The East End includes most of the boroughs of Hackney, Tower Hamlets, and Newham. The heavily built-up neighborhoods around central London gradually give way to more spacious communities, which Londoners call *suburbs.*

A broad band of countryside, called the Green Belt, surrounds Greater London. City planners set aside this land to keep the built-up areas from spreading endlessly. Just outside the Green Belt are communities called *new towns,* which the planners established to ease overcrowding in London.

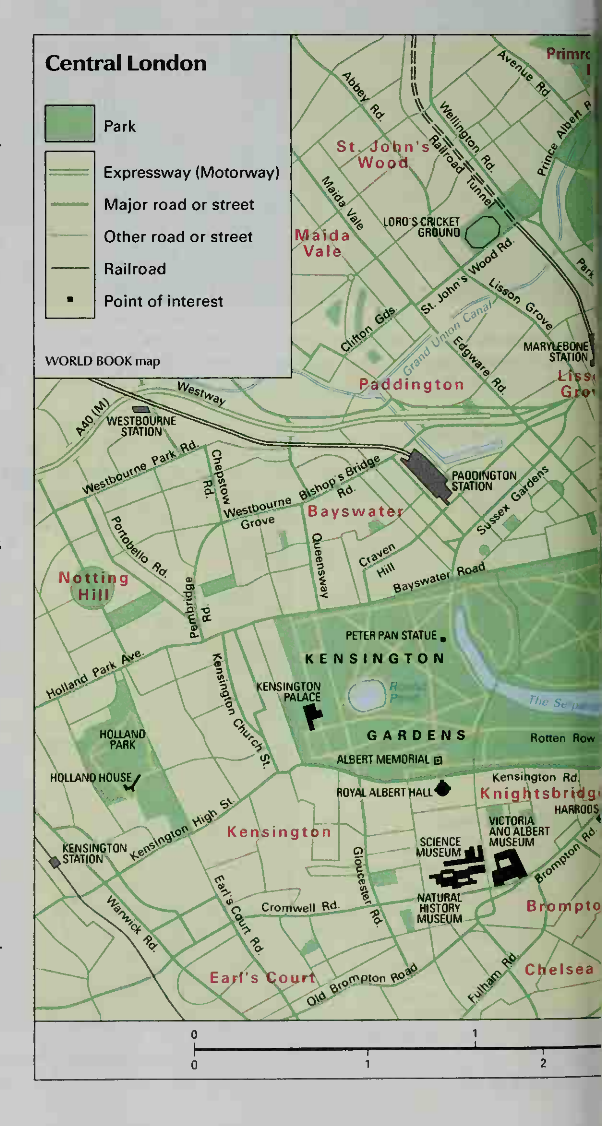
The people

London is so large that many Londoners think of themselves mainly as residents of a particular district, such as Chelsea, Soho, or Hampstead. The various districts were once separate villages, and many have kept their special character. Hampstead, for example, is known for its artists and writers, and Soho is known for its restaurants.

Ancestry. According to tradition, the only "real" Londoners are *cockneys.* A cockney is anyone born within hearing distance of the bells of St. Mary-le-Bow, a historic church in the City. The cockney accent was made famous by Eliza Doolittle, the uneducated cockney girl in George Bernard Shaw's play *Pygmalion* and its musical version, *My Fair Lady.*

London has attracted residents from other parts of the United Kingdom as well as from many countries around the world. The ancestors of today's Londoners include people who came from the United Kingdom, Ireland, the West Indies, and a number of other countries in Europe, Asia, and Africa.

Religion. Many Londoners are members of the Church of England or other Protestant churches. Other





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The Houses of Parliament overlook the River Thames in Westminster, the oldest part of London's West End. Westminster has been the center of British government for more than 1,000 years. The clock and clock tower, *right,* are a famous London landmark known as Big Ben.

Camden Town
King's Cross
Pentonville
Islington
Hoxton
Haggerston
Somers Town
Regent's Park
Finsbury
Shoreditch
Clerkenwell
St. Luke's
Bloomsbury
Spitalfields
Marylebone
Holborn
CITY
St. Giles
Whitechapel
Soho
Strand
EAST END
Mayfair
WEST END
St. James's
SOUTH BANK
Southwark
Belgravia
Westminster
Bermondsey
Newington
Vauxhall
Walworth
Pimlico
LONDON ZOO
REGENT'S PARK
OPEN AIR THEATRE
MADAME TUSSAUD'S
PLANETARIUM
TELECOM TOWER
BROADCASTING HOUSE (B.B.C.)
WALLACE COLLECTION
MARBLE ARCH
U.S. EMBASSY
ROYAL ACADEMY OF ARTS
GREEN PARK
LANCASTER HOUSE
ST. JAMES'S PALACE
BUCKINGHAM PALACE
VICTORIA MEMORIAL
ST. JAMES'S PARK
BELGRAVE MANSION
VICTORIA STATION
WESTMINSTER CATHEDRAL
DUKE OF YORK'S HEADQUARTERS
KING'S CROSS STATION
ST. PANCRAS STATION
BRITISH LIBRARY
EUSTON STATION
THOMAS CORAM FOUNDATION
CORAM'S FIELDS
DICKENS HOUSE
UNIVERSITY OF LONDON
BRITISH MUSEUM
GRAY'S INN
SADLER'S WELLS THEATRE
SMITHFIELD MARKET
BARBICAN ARTS AND CONFERENCE CENTRE
MUSEUM OF LONDON
LIVERPOOL ST. STATION
WHITECHAPEL ART GALLERY
LINCOLN'S INN
ROYAL COURTS OF JUSTICE
DRURY LANE THEATRE
ROYAL OPERA HOUSE
NATIONAL GALLERY
SOMERSET HOUSE
PICCADILLY CIRCUS
TRAFALGAR SQUARE
CANADA HOUSE
ADMIRALTY ARCH
CHARING CROSS STA.
BANQUETING HOUSE
HORSE GUARDS
10 DOWNING ST.
BIG BEN
WESTMINSTER ABBEY
NEW SCOTLAND YARD
HOUSES OF PARLIAMENT
TATE BRITAIN GALLERY
VICKERS BUILDING
MIDDLE TEMPLE
INNER TEMPLE
THAMES LINK CITY STA.
OLD BAILEY
GENERAL POST OFFICE
GUILDHALL
ST. PAUL'S CATHEDRAL
ST. MARY-LE-BOW
BANK OF ENGLAND
STOCK EXCHANGE
ROYAL EXCHANGE
LLOYD'S
MANSION HOUSE
FENCHURCH ST. STATION
MERMAID THEATRE
BLACKFRIARS STA.
CANNON ST. STA.
THE MONUMENT
TOWER OF LONDON
WORLD TRADE CENTRE
H.M.S. BELFAST
LONDON BRIDGE STATION
DESIGN MUSEUM
TATE MODERN GALLERY
GLOBE THEATRE
SOUTHWARK CATHEDRAL
ROYAL NATIONAL THEATRE
NATIONAL FILM THEATRE
QUEEN ELIZABETH HALL
HAYWARD GALLERY
ROYAL FESTIVAL HALL
SHELL CENTRE
LONDON EYE
COUNTY HALL
LONDON AQUARIUM
WATERLOO STATION
OLD VIC THEATRE
ST. GEORGE'S CATHEDRAL
LAMBETH PALACE
IMPERIAL WAR MUSEUM
ELEPHANT AND CASTLE STA.
River Thames
North
0 1 2 3 4 5 Miles
0 1 2 3 4 5 6 7 8 Kilometers



Attractive town houses in the borough of Kensington and Chelsea are some of the most comfortable housing found in the *inner boroughs,* the areas such as this one that surround central London. In the *outer boroughs,* which lie farther from central London, most residents live in single-family homes.

© L.L.T. Rhodes, Tony Stone Images

religions represented in London include Islam, Judaism, and Roman Catholicism.

Residential areas and housing. Two-thirds of Londoners live in suburban communities in the *outer boroughs.* These boroughs, such as Barnet, Havering, Croydon, and Hounslow, lie farthest from central London. The suburbs have their own schools, churches, offices, stores, businesses, and places of recreation. Most of the residents live in comfortable single-family houses, each of which has its own piece of ground. Most suburban families own their homes.

London's oldest and most crowded residential areas lie in the *inner boroughs.* These boroughs, such as Camden, Islington, Hackney, Tower Hamlets, Southwark, and Lambeth, surround the City and the West End. Most of London's poor families and immigrants live in rented houses and apartments in these boroughs. But some parts of these boroughs have become fashionable. In the former dock areas in Tower Hamlets, for example, old warehouses have been converted into expensive apartments.

The chief exceptions to run-down housing in the inner boroughs of London are in the borough of Kensington and Chelsea, and the City of Westminster. Westminster includes most of the West End. A number of the wealthiest families of London live in expensive apartment buildings in Westminster, especially in the exclusive Mayfair district. This prosperous section extends northwest to the Hampstead district in the borough of Camden, which has many comfortable homes. The borough of Kensington and Chelsea has a number of expensive apartment buildings for people who work in central London.

The City has few homes or apartments. But in the 1960's and 1970's, a large housing development called the Barbican was constructed along its northern edge.



© Philip Wolmuth, Panos Pictures

Run-down apartment buildings are typical of housing in much of the *inner boroughs,* which surround central London. These boroughs have the oldest and most crowded residential areas.

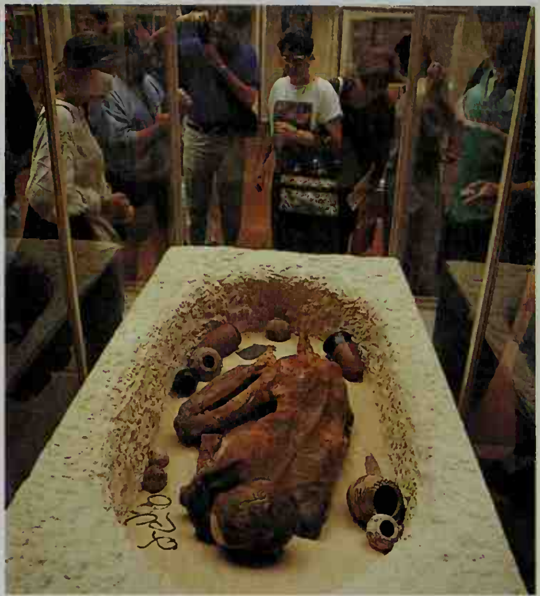
This development provides living quarters for about 4,500 people.

Education. More than a million students attend about 2,000 elementary and 600 secondary schools in London. Most of the schools are publicly owned and operated. Each of London's boroughs runs its own schools.

London has several of Britain's famous *public schools.* Although these schools are called public, they are actually private. London's public schools include Harrow and St. Paul's, which admit only boys, and Westminster, which admits girls and boys. All three schools trace their history back more than 400 years.

London has long been the United Kingdom's chief center for advanced study and research. The University of London is the nation's largest traditional university. A number of small colleges in London specialize in such fields as art or engineering.

Social problems. Like most large cities throughout the world, London has such problems as poverty, crime, and drug addiction. The problems are most severe in the crowded areas bordering central London, which contain some of the poorest communities in England. In several of the poorer boroughs, unemployment among young people is widespread. Many young people turn to shoplifting or street robbery or more serious crimes, and some also experiment with drugs. Housing remains a serious problem in the inner boroughs, and there are thousands of homeless people throughout the city.



© Jeremy Grayson, Bruce Coleman Ltd.

An archaeology exhibit at the British Museum

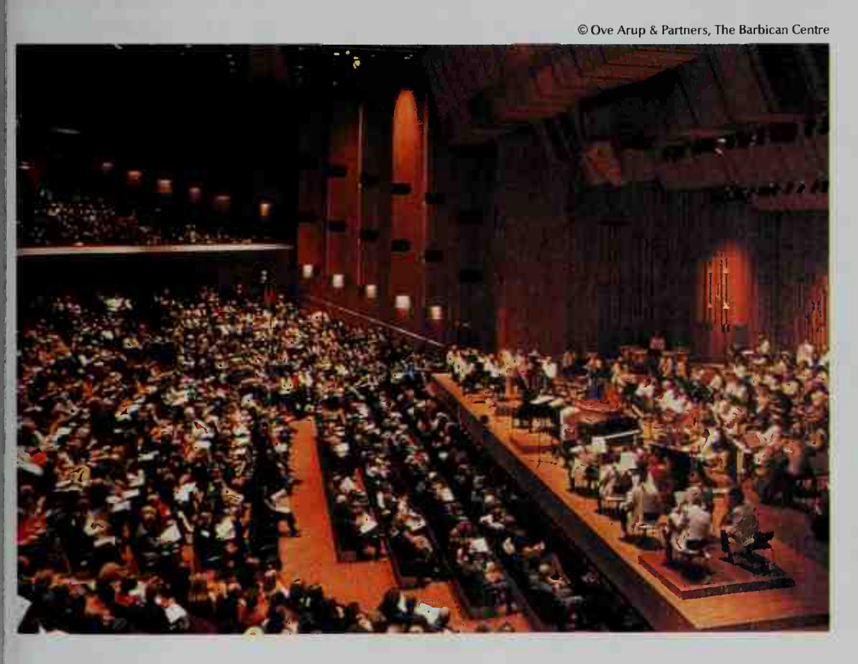
Cultural life and recreation

The arts. London ranks as one of the world's leading cultural centers. It has many professional theaters, whose presentations range from contemporary works to the plays of English dramatist William Shakespeare. The Royal National Theatre stages a range of modern and classical plays in three theaters in the cultural center on the South Bank. The Royal Shakespeare Company also presents plays in various London theaters.

London has five world-famous symphony orchestras—the BBC (British Broadcasting Corporation) Symphony, the London Philharmonic, the London Symphony, the Philharmonia, and the Royal Philharmonic orchestras. Most major concerts are held in the Royal Festival Hall or the Queen Elizabeth Hall, which are part of the South Bank cultural center, or in the Barbican Centre, a cultural complex in the City. The Royal Albert Hall, an older concert hall near Kensington Gardens, has a popular series of summer concerts.

The Royal Opera House at Covent Garden is the home

© Ove Arup & Partners, The Barbican Centre



The Barbican Centre is a cultural complex in the part of central London known as the City. The center presents such events as concerts, *shown here,* and performances of the Royal Shakespeare Company.

of the United Kingdom's Royal Opera and the Royal Ballet. The English National Opera and English National Ballet perform at the London Coliseum near the Strand.

London's public art galleries include the National Gallery, on Trafalgar Square; the Tate Britain gallery, in south Westminster; the Tate Modern gallery, at Bankside; and the Wallace Collection, housed in a mansion south of Regent's Park. Important visiting art exhibits are held at the Royal Academy of Arts, which is just west of Piccadilly Circus, and the Hayward Gallery, part of the South Bank cultural center.

Museums and libraries. The British Museum, in the West End, is one of the world's most famous museums. It houses a priceless collection of objects from ancient civilizations. Other famous museums in London include the Natural History Museum, the Science Museum, and the Victoria and Albert Museum, which has one of the world's largest collections of decorative art. All three are just south of Kensington Gardens. The Museum of London, in the City, houses the collections of the London Museum and Guildhall Museum. Both collections contain items related to London's history.

The British Library, the United Kingdom's national library, contains millions of books as well as maps, stamps, and other objects. The huge library stands next to the St. Pancras railway station. London has over 400 public libraries, which are run by the City and borough governments.

Recreation. Many Londoners enjoy shopping at the city's large department stores, its many small specialty shops, and the colorful street markets that sell everything from fresh fruits and vegetables to bargain jewelry, clothing, and antiques. Popular street markets include Petticoat Lane (Middlesex Street) market, which is located at the eastern edge of the City; Berwick Street market, in Soho; and Portobello Road market, near Kensington Gardens.

Soccer, which the British call *football,* is the most popular sport in London. The London area has 13 professional teams. They play on Saturdays from August through May. Each year, the national championship final is held in May.

Many amateur and professional teams in London play rugby, a game played with an oval ball. The rugby season lasts from September through May. International rugby union matches and national championships are held at the Twickenham Rugby Ground in the borough of Richmond upon Thames.

Cricket, a game played with bats and a ball, is a popular amateur and professional sport played in spring and summer. Major matches take place at Lord's Cricket Ground, just west of Regent's Park, and at the Oval, a cricket ground in the borough of Lambeth.

The London Marathon is a popular sports event that takes place every April. Thousands of people compete in this foot race of 26 miles 385 yards (42.2 kilometers) that begins in southeast London and finishes in Westminster in the broad, treelined avenue called the Mall.

Londoners also enjoy such sports as dog racing, golf, horse racing, swimming, and tennis. The Crystal Palace National Sports Centre, which is located in the borough of Bromley, has facilities for many sports. The annual All-England (Wimbledon) Championships, which is probably the most famous tennis tournament in the world, takes place in late June and early July. The tournament is held at the All-England Lawn Tennis & Racquet Club in Wimbledon in the borough of Merton. London has a number of licensed betting shops, where people place bets on horse races, soccer games, and other sports events.

In the evening, many Londoners enjoy watching television, seeing a film at one of London's many *cinemas* (motion-picture theaters), eating at a restaurant, or going to the theater. On summer evenings, gardening is a popular pastime. Many people also like to spend the evening at their neighborhood *pub* (public house). The pubs serve beer and other drinks, and in many of them, patrons can play games of darts or pool. London also has many public and private nightclubs. The St. James's district, in the West End, is the home of London's fa-



© Travelpix/FPG

London's street markets offer a wide variety of goods. They are popular with native Londoners as well as tourists.


© Peter Bennett, Viesti Associates

A neighborhood pub, one of thousands in London, is filled with nightly crowds socializing over beer and other drinks.

mous private clubs, a few of which admit only men. Politicians, civil servants, and businesspeople meet in the clubs for meals and conversation.

Visitor's guide

London has long been a popular tourist destination. This section describes some of the interesting places to visit in London. See other sections of the article for discussions of additional places of interest.

Palaces. Over the centuries, Britain's rulers have lived in a number of splendid palaces in London. Few of these buildings survive in their original form. Most have been turned into museums or showplaces. For example, the superb royal dining hall called the Banqueting House is almost all that remains of Whitehall Palace. This magnificent palace, in Whitehall, was a residence of England's royal family from 1529 to 1698. The English architect Inigo Jones completed the Banqueting House for King James I in 1622. Today, it is preserved as a showplace. For a picture of the Banqueting House, see **Jones, Inigo**.

St. James's Palace, between St. James's Park and Green Park in the West End, was the official royal residence from 1698 to 1837. The palace now provides office space for the staff of the royal household as well as apartments for certain members of the royal family.

Buckingham Palace has been the official royal residence since 1837. It was originally the home of John Sheffield, Duke of Buckingham, who lived there in the early 1700's. Other famous London palaces include Kensington Palace in Kensington Gardens and Hampton Court Palace by the Thames in the borough of Richmond-upon-Thames.

The Houses of Parliament, in Westminster, serve as the meeting place of the House of Commons and the House of Lords, the two branches of the United Kingdom's legislature. The buildings are officially called the Palace of Westminster. They were constructed during the mid-1800's to replace earlier palace buildings that had burned down in 1834. A huge bell in the clock tower of the Houses of Parliament has boomed out the hours since 1859. Londoners refer to the bell, the clock, and the clock tower as Big Ben. During World War II (1939-1945), German bombs destroyed part of the House of Commons. It was rebuilt after the war.

The chief building that survived the 1834 fire was Westminster Hall, an assembly hall completed in 1099 and remodeled during the late 1300's. It stands near the center of the Houses of Parliament. A terrorist bomb slightly damaged the hall in 1974.

Churches. St. Paul's Cathedral and Westminster Abbey are the most famous churches in London. St. Paul's serves as the seat of the London diocese of the Church of England. The great English architect Sir Christopher Wren built the church between 1675 and 1710 to replace the original St. Paul's, which was destroyed in the Great Fire of 1666. The church's huge dome towers 365 feet (111 meters) above the ground. Wren also rebuilt more than 50 other churches destroyed or damaged in the Great Fire.

The history of Westminster Abbey reaches back more than 900 years. In 1066, William the Conqueror was crowned king there. Since then, almost all the country's monarchs have been crowned there. The church has been added to and remodeled over the centuries, but



© Photo Trends

Westminster Abbey, one of London's most famous churches, is the site of coronations and royal weddings. Also, many important figures of British history are buried in the abbey.

some of its present architecture dates from the 1200's.

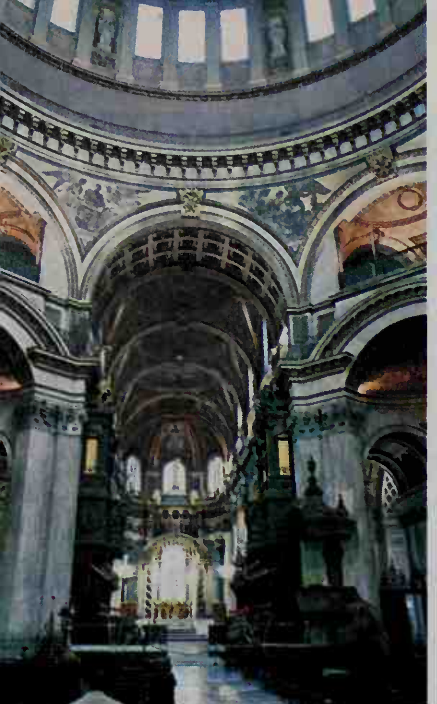
London has many other famous churches. The oldest is the Chapel of St. John in the Tower of London. It dates from the late 1000's and still has some of its original architecture. Westminster Cathedral, a familiar landmark in the West End, is England's chief Roman Catholic church. It was completed in 1903.

Squares. Much of London's West End is laid out around a series of squares. The best-known square is Trafalgar Square. Nelson's Column in the center towers 185 feet (56 meters) above the square. It consists of a tall granite column topped by a giant stone statue of the British naval hero Horatio Nelson.

Other well-known West End squares include Bedford, Berkeley, Grosvenor, and Russell squares. Large, fashionable homes once lined these squares, and trees and gardens grew in the open space at the center of each square. The central landscaped areas remain. But most of the houses have been turned into hotels or offices.

Parks. London's largest parks are the *royal parks.* These parks once formed part of royal estates, and they are still owned by the British monarch. But they are now set aside for public use. Central London has five royal parks: St. James's Park, Green Park, Hyde Park, Kensington Gardens, and Regent's Park.

St. James's Park has a large lake with wild fowl, and Green Park is noted for its shade trees and walking paths. The Mall borders St. James's Park on the north and forms the chief route for royal parades. Hyde Park is famous for Marble Arch, a triumphal arch near its northeast corner, and for Speakers' Corner, just south of the arch. Large crowds gather at Speakers' Corner to hear people express their opinions on politics, religion, and many other topics. Hyde Park also has an artificially cre-





© John Budde from Louis Mercier

St. Paul's Cathedral





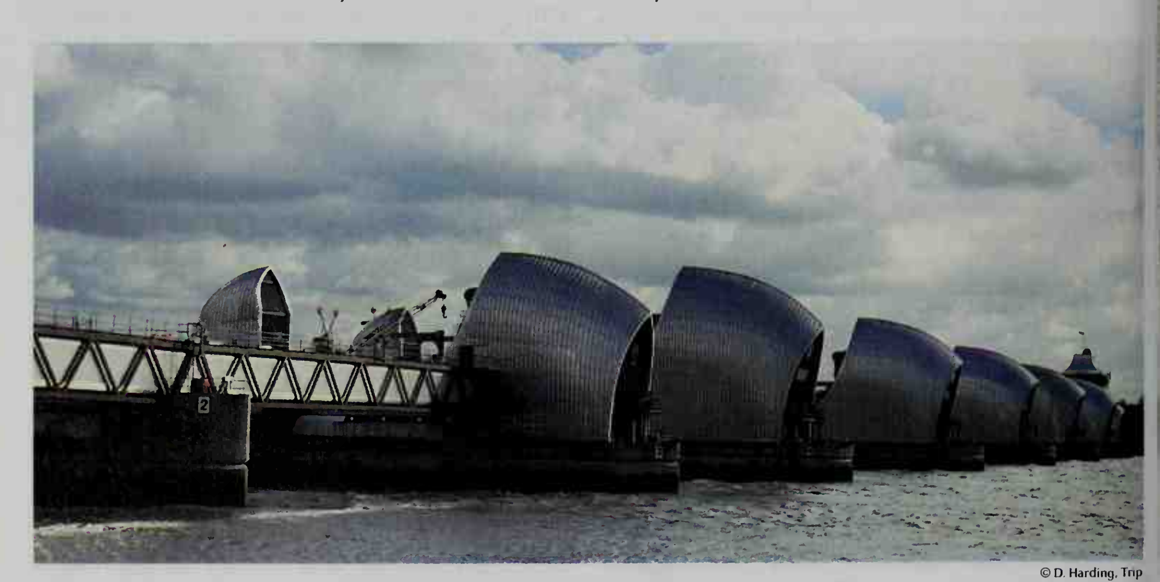
© Janet Gill, Tony Stone Images

The Tower of London

ated lake called the Serpentine, popular with Londoners for boating, fishing, and swimming. Kensington Gardens, adjoining Hyde Park, has beautiful formal gardens and a famous statue of Peter Pan. Regent's Park contains the London Zoo.

More than 80 other public parks lie in or near central London. Hampstead Heath, in the borough of Camden, offers fine views of central London from Parliament Hill. Battersea Park, in the borough of Wandsworth, includes a boating lake and a children's zoo. Its architectural highlight is the Peace Pagoda overlooking the Thames. Kew Gardens, also called the Royal Botanic Gardens, contain one of the world's largest collections of tree and shrub species and hothouse plants. The gardens are in the borough of Richmond-upon-Thames.

The Tower of London, which borders the City, is London's oldest landmark. It lies on the north bank of the Thames in the East End, in the borough of Tower Hamlets. It consists of a group of structures built around a central tower, which came to be called the White Tower, and surrounded by two stone walls. The White Tower dates from the late 1000's. The Tower of London has served as a fortress, a palace, and a prison. Two of King Henry VIII's six wives were beheaded on the site in the



© D. Harding, Trip

The Thames Barrier, in East London, consists of enormous movable gates that can be closed to seal off the River Thames. It is a protection against tidal surges that come from the North Sea.

1500's. Today, the Tower of London is a national monument and museum. The White Tower holds an armor collection that was started by King Henry VIII. The Crown Jewels—some of the world's most precious stones set in crowns, robes, and other items used in royal ceremonies—are exhibited at the Jewel House.

The Inns of Court are the United Kingdom's center for the study and practice of law. They consist of four groups of rambling buildings and courtyards just west of the City. Each group houses one of the four Inns of Court: Gray's Inn, Lincoln's Inn, the Inner Temple, and the Middle Temple. Some of the architecture of the Inns was built hundreds of years ago.

Other places of interest lie outside central London. For example, the borough of Greenwich, in east London, has a famous group of buildings designed in the late 1600's by Sir Christopher Wren for the Greenwich Hospital. For a picture of the buildings, see **Wren, Sir Christopher**.

Nearby is the National Maritime Museum, which features exhibits on British naval history. South of the museum, in Greenwich Park, is the former site of the Royal Greenwich Observatory. Although the observatory is no longer there, the site remains the location of the Greenwich Meridian, the starting point for the world's time zones.

The Thames Barrier stands a little farther east, at a point in the Thames called Woolwich Reach. River trips to view the flood barrier have become popular.

Ceremonies. Ceremonial guards, usually red-coated sentries of the Guards Division, stand on duty at Buckingham Palace and St. James's Palace. Most mornings, the famous changing-of-the-guard ceremony takes place at the front gates of Buckingham Palace. The royal Household Cavalry also holds a daily changing of the guard at Horse Guards Parade, a parade ground next to the Horse Guards building in Whitehall.

Another ceremony takes place at the Tower of London. The tower is guarded by members of the Guards Division and staffed by colorfully outfitted *yeomen warders,* also called *beefeaters.* Each night at 10 o'clock, the chief yeoman warder, accompanied by the tower guard, locks the tower and presents the keys to the tower's governor. This custom is nearly 700 years old.

Two of London's most spectacular ceremonies are Trooping the Colour and the Lord Mayor's Show. Each year in June, Trooping the Colour forms part of the official birthday celebration of the British monarch, Queen Elizabeth II. Riding in a horse-drawn carriage, the queen leads the Household Cavalry past cheering crowds along the Mall to Horse Guards Parade. There, the queen inspects the troops, and the *colour* (ceremonial flag) is carried in review.

The Lord Mayor's Show takes place on the second Saturday in November to celebrate the election of a new lord mayor of the City. The new lord mayor, dressed in traditional robes and riding in a horse-drawn coach, leads a parade through the streets of the City.

Economy

London is the United Kingdom's chief economic center. It is also one of the world's leading centers of finance and trade. Many British manufacturing industries have their home offices in London. The national and local governments employ many of London's workers. About a third of the city's jobs are concentrated in central London.

Manufacturing. London's leading industries include printing and publishing and the manufacture of clothing and textiles, electrical and electronic products, food products, and pharmaceuticals. Much of London's printing activity is concentrated in the Docklands area, east of the City.

Another industrial area extends east along the Thames, from the borough of Newham to the limits of Greater London and beyond. This area specializes in



© Bachman, Photo Researchers

The changing-of-the-guard ceremony takes place most mornings at the gates of Buckingham Palace. The palace is the London home of the British monarch.

food processing and the manufacture of chemicals. A similar industrial belt lies alongside the River Lea, which follows the eastern border of the boroughs of Enfield, Haringey, Hackney, and Tower Hamlets. The borough of Barking and Dagenham in east London is a center for the manufacture of automobiles and automobile parts.

London's newer industrial areas developed in the western boroughs. The largest area is the Park Royal Business Park in the boroughs of Hammersmith and Fulham, Brent, and Ealing. Factories there specialize in consumer goods, such as cosmetics, electronic products, and food products.

Trade. The Port of London Authority controls ships at 86 terminals along 90 miles (150 kilometers) of the Thames. In the past, the chief docks and wharves were just east of London Bridge and Tower Bridge. But the growth of container shipping during the 1960's required new facilities to handle container ships. These ships are designed to carry cargo packed in huge crates called *containers.* Container facilities were built at the town of Tilbury, near the mouth of the Thames. Today, ocean ships load and unload thousands of containers at the Tilbury docks. Trains and trucks transport the containers between Tilbury and London.

London has thousands of wholesale stores and warehouses and tens of thousands of retail stores. New Covent Garden Market is a famous wholesale market for fresh fruits, vegetables, flowers, and plants. In 1974, Covent Garden Market moved from its 300-year-old site near the Strand to a site on the south bank of the Thames in the borough of Wandsworth. Many of London's retail stores are small shops. They sell such items as clothing or furniture.

Finance and business. Great financial institutions in the City include the Bank of England, the national bank that handles government financial operations for the United Kingdom; the London Stock Exchange, one of the world's busiest stock exchanges; and Lloyd's, a famous insurance society. All of the United Kingdom's major banks and many insurance companies have headquarters in the City.

Greater London has tens of thousands of business offices, which house an enormous variety of companies. Major office centers outside the City and West End are located at Canary Wharf in Tower Hamlets, in Croydon, and in Hammersmith and Fulham.

Tourism. Millions of tourists visit London each year. Providing goods and services for these visitors is one of London's leading industries. The largest of London's many hotels are in the West End and in the western outlying areas near Heathrow Airport. The West End also has many of London's finest restaurants.

Transportation. Expressways and underground and surface railways carry commuters between the outlying areas and central London each workday. The London subway system, which Londoners call the *tube* or the *underground,* is one of the world's largest subway systems. It includes more than 100 miles (160 kilometers) of underground rail lines. London's famous red double-deck buses carry passengers throughout the city.

London Underground Limited operates the subway system. Privately owned companies operate surface commuter trains.

Heathrow Airport, in far western London, ranks as one of the busiest airports in the world. Londoners also use Gatwick Airport, which lies about 30 miles (48 kilometers) south of Greater London, and Stansted Airport, about 30 miles northeast of London. The smaller London City Airport, which is popular with businesspeople, lies in the former dock areas along the Thames, just east of the City.

Communication. London is the United Kingdom's chief communications center. All of the country's national newspapers have their main offices in London, including such influential newspapers as the *Daily Telegraph* and *The Times* and such popular papers as the *Daily Mirror, News of the World,* and *The Sun.* London also has one evening newspaper, the *Evening Standard.* At one time, most of the national newspapers had offices in the City on Fleet Street, and the street came to be identified with British national journalism. During the 1980's, however, when new technology replaced old methods of production, many of the newspapers on Fleet Street moved to new factories and offices in the redeveloped Docklands area just east of the City.

The British Broadcasting Corporation (BBC) is the na-


© B. Turner, Trip from Viesti Associates



The City is London's financial district and the home of many banks, commodity exchanges, and other financial institutions. The trading floor of a futures exchange in the City is shown here.



© C. Kapolka, Trip

London's subway system was the first underground passenger-train system in the world. It was begun in 1863. It is also one of the longest subway systems in the world. Londoners call it the *tube* or the *underground.*

tional radio and television service. It has its main offices and studios in Broadcasting House, just south of Regent's Park, and in Television Centre, in the borough of Hammersmith and Fulham. The BBC operates on a nonprofit basis and has no commercial advertising. The owners of television sets in the United Kingdom pay an annual license fee that finances BBC programs.

Both the Independent Television Commission and the Radio Authority are also based in London. The Independent Television Commission regulates the United Kingdom's commercial television service, and the Radio Authority oversees the commercial radio network.

Government

The Greater London Authority governs the entire region known as Greater London. The authority is composed of a mayor and 25 assembly members. The mayor and assembly members are elected every four years. The authority is responsible for transportation, police and fire protection, and other citywide services. Several other public agencies also provide a number of services.

Borough governments. Each of London's 32 boroughs has its own government, which consists mainly of an elected council headed by a mayor. Borough residents elect new councils every four years. The size of the councils varies from borough to borough.

The borough councils are responsible for most local government services. The exceptions include police and fire services and public transportation. The boroughs of London receive most of their income from grants from the national government. But they also raise money from property taxes and rents.

The government of the City of London is organized much as it was hundreds of years ago, when many thousands of people lived inside the City's walls. Today, the City of London has far fewer residents than even the smallest borough. However, it is London's business and financial center and has equal standing with the 32 boroughs.

An organization called the Corporation of London governs the City. It acts through the Court of Common Council. The Court of Common Council consists of at least 100 council members, 24 aldermen, and the lord mayor, who also serves as a 25th alderman. The lord mayor is elected to a one-year term by the members of the *liveries* (guilds), which represent the City's trades and professions. Voters in the City elect the other 24 aldermen to life terms and the members of the Common Council to one-year terms.

Other public agencies. London Transport provides several public transportation services. Its board members are appointed by the British government.

The Metropolitan Police is another agency of the national government. The Metropolitan Police provides police protection for all of Greater London except the City and has headquarters at New Scotland Yard. The City has its own police force.

The London Fire and Civil Defence Authority provides fire department services. Its membership consists of one representative from each borough council and the City council. The councils appoint each of these representatives.

History

London began in A.D. 43, when armies of the Roman Empire started to conquer Britain. The Romans built a trading port on the Thames near present-day London Bridge. They probably chose this site because the riverbanks east of this point were too marshy for settlement. The Romans called the port *Londinium.* The name *London* comes from this word.

By the early 200's, the Romans had built a wall around London, possibly to protect it from raiders. This wall, and the ones that later replaced it, formed London's boundaries for hundreds of years.

In 410, barbarian invaders attacked Rome, and the Roman troops in Britain were called home to fight the invaders. This date thus marks the end of Roman control over Britain. Most inhabitants abandoned London, and the city declined.

The Middle Ages, the period of European history from the 400's to about 1500, began when the barbarian invaders broke Rome's hold over its huge empire. Sea-

faring Germanic tribes—Saxons and related tribes called Angles and Jutes—attacked eastern Britain, where they eventually settled and created a number of small kingdoms. A new London grew up. It was a Saxon trading town on a site just west of the old Roman city, and it was known as Lundenwic. Vikings from Denmark attacked the town in the 800's. In the 880's, Alfred the Great, the king of the West Saxons, united most of England into a single kingdom to resist the Vikings. He reestablished London within the walls of the old Roman city. The site of Lundenwic was abandoned and forgotten.

In the mid-1000's, the Anglo-Saxon king Edward the Confessor built a palace and a monastery church beside the Thames about 2 miles (3 kilometers) southwest of London. The modern City of Westminster grew up around this site. The monastery, or *minster in the west,* became the start of Westminster Abbey. The Palace of Westminster became England's center of government, and it served as the chief residence of England's rulers until the 1520's.

In 1066, William the Conqueror, a French nobleman, seized control of England and was crowned king in Westminster Abbey. William granted Londoners self-government. But he built a castle, now called the White Tower, just outside London to impress them with his authority and power. The White Tower today forms the central part of the Tower of London.

Other London landmarks also appeared during the Middle Ages. About 1090, work began on Old St. Paul's Cathedral to replace a church destroyed by fire. Builders finished it about 200 years later. In 1209, London Bridge became the first stone bridge across the Thames. It replaced a wooden bridge, often rebuilt, that had spanned the river since Roman times.

London's craft and trade guilds began to develop in the 1100's. Each guild represented certain craftworkers or tradespeople, such as bakers, carpenters, goldsmiths, and grocers. The guilds were also called *livery companies* because each had its own *livery*—that is, official robes that the members wore on special occasions. Each guild also had its own splendid meeting hall. A new central guildhall and center for local government was completed by 1430.

Guild members elected London's first mayor in the 1190's. In 1215, King John confirmed London's right to govern itself. Some historians estimate that by the late 1400's, London had about 75,000 people. The city's mayor had grown so important that he came to be called the *lord mayor.*

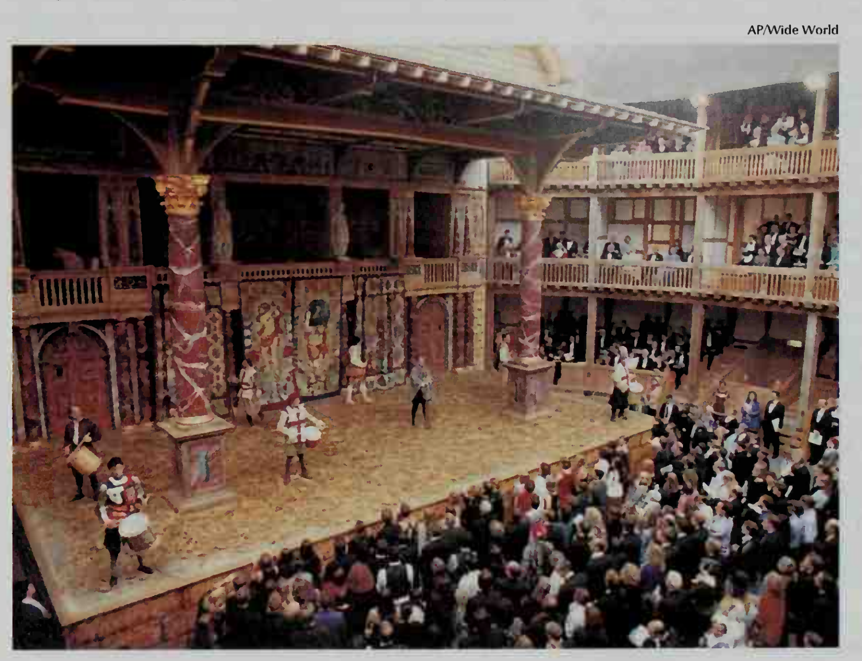
Expansion beyond the walls. London grew rapidly during the 1500's and the first half of the 1600's. Under the reign of King Henry VIII, who ruled England from 1509 to 1547, nobles built estates to the west, just outside London's walls. What is now the West End thus began to develop. The king owned about a dozen palaces in the London area, including the Palace of Westminster. In 1547, the year Henry died, the Palace of Westminster became the meeting place of Parliament.

London developed into an important world trading center under Queen Elizabeth I, who reigned from 1558 to 1603. As the merchants grew increasingly rich, they built splendid homes, where they conducted most of their business. They also met and did business at the Royal Exchange building, which opened in 1570 just north of London Bridge.

England's first public theaters opened in London's suburbs during Queen Elizabeth's reign. They attracted such large, noisy crowds that they were prohibited inside London's walls. One of the most popular theaters was the Globe, across London Bridge in Southwark. William Shakespeare began to present his plays there about 1599 (see **Shakespeare, William** [England of Shakespeare's day]). A replica of the Globe was completed in 1996 and officially opened in 1997.

By the mid-1600's, London had about half a million people. Most Londoners lived outside the walls in such

AP/Wide World



The new Globe Theatre, which opened in 1997 in the South Bank, is a replica of the one in which William Shakespeare began presenting his plays about 1599. The spectators on the main floor stand in the space in front of the stage, just as the "groundlings" did in Shakespeare's time.



Long View of London (1616), an engraving by Claes Jansz Visscher; British Museum, London

London in the early 1600's sprawled along both banks of the Thames and overflowed onto old London Bridge, *right.* The Great Fire of 1666 destroyed many of the houses and shops on the bridge and most of the buildings on the north bank, including Old St. Paul's Cathedral, *upper left.*

districts as Clerkenwell, St. Giles, and Whitechapel, which were rapidly becoming slums. The area inside the walls gradually came to be known as *the City.*

War, plague, and fire struck London in the mid-1600's. A struggle for power between King Charles I and Parliament resulted in civil war in 1642. London sided with Parliament, led by Oliver Cromwell and other Puritans. The Puritans were a religious and political group who opposed not only the king but also the established Church of England and the luxurious life of the nobility. The Puritans seized control of the government and beheaded the king in 1649.

London grew less prosperous under Puritan rule. The Puritans also made themselves unpopular by closing the theaters. When Parliament restored the monarchy in 1660, most Londoners welcomed the new king, Charles II, the son of Charles I.

The Great Plague—a terrible epidemic of *bubonic plague*—broke out in London in 1665. The disease was spread by fleas from infected rats, which swarmed through slums surrounding the City. Before the epidemic died down in 1666, it had taken about 100,000 lives.

On Sept. 2, 1666, the Great Fire of London broke out in a baker's shop on Pudding Lane in the City. It was finally brought under control five days later. Amazingly, the fire caused only a few deaths. But most of the City, which was built largely of wood, lay in ashes. The losses included St. Paul's Cathedral and more than 80 other churches, the Royal Exchange, the halls of 44 craft and trade guilds, and about 13,000 houses.

Rebuilding the City. Londoners rebuilt the City with brick and stone instead of timber. The great architect of the new City was Sir Christopher Wren. He rebuilt many structures lost in the fire, including St. Paul's Cathedral. But few people returned to live in the City. Many merchants moved to the West End, where attractive residential squares were being laid out in such sections as Bloomsbury and Mayfair.

London's businesses soon recovered from losses suffered in the Great Fire. A new Royal Exchange opened in the 1670's. But the favorite places for doing business were the many coffee houses that sprang up in and near the City. Lloyd's insurance society started in the coffee house of Edward Lloyd about 1690. The London Stock Exchange operated in coffee houses, such as Jonathan's, in the early 1700's. Coffee houses on or near Fleet Street were a chief source of news, and so London's newspaper industry grew up in this area during the 1700's.

The world's largest city. By 1800, London had about a million people, more than any other city in the world. It remained the world's largest city throughout the 1800's.

One of the chief events of the 1800's was the spread of the Industrial Revolution, a period of rapid industrialization that began in Britain during the 1700's. The revolution resulted largely from the growth of factories, many of which sprang up in London. But London's main role in the revolution was to develop markets for the factory-produced goods. The City's merchants and bankers thus made enormous fortunes. Although wealthy Londoners made their money in the City, they spent it in the West End. By the mid-1800's, the West End had become famous for its fashionable social life.

The Industrial Revolution brought misery as well as prosperity to London. Factory, dock, and warehouse workers were desperately poor. They lived with their families in crowded, disease-ridden slums, chiefly in the East End (see **City** [picture: The Industrial Revolution]). During the second half of the 1800's, laws were passed to aid the working class. Conditions in London's slums then began slowly to improve.

The growth of the suburbs. During the 1800's, more and more Londoners moved to the outlying areas. This rapid suburban growth became possible largely because of improved transportation.

London Bridge had formed London's only link with the South Bank until 1750, when Westminster Bridge was completed. Engineers built other bridges after 1750.

Horse-drawn vehicles provided the chief means of transportation throughout most of the 1800's. But railroad passenger service began to develop rapidly in London during the mid-1800's.

Starting in the 1830's, a ring of railroad stations went up around central London. The first, Euston Station, opened in 1837. It was followed in the 1850's and 1860's by King's Cross, Paddington, Victoria, and St. Pancras stations. London's subway system was the first underground passenger-train system in the world. It started in 1863 with steam trains that carried passengers underground between the railway stations that ringed central London.

The first major reform of London's government took place in 1888. The County of London was formed that year, and the London County Council was organized as its chief governing body. The county covered an area about a fifth the size of present-day Greater London. The City remained self-governing. In 1899, the county was divided into 28 boroughs.

By 1901, the City's population had dropped to about 27,000. Meanwhile, the population of the County of London had soared to about 4 $\frac{1}{2}$ million. This enormous suburban growth continued during the 1900's.

The Blitz. During World War I (1914-1918), the United Kingdom fought on the side of France, the United States, and other Allies against Germany, Austria-Hungary, and other Central Powers. German airships dropped a few bombs on London during that war. But German bombers caused much worse damage during World War II (1939-1945), when the United Kingdom and many of the same Allies again fought Germany and its supporters Italy and Japan.

In September 1940, Germany began an all-out air attack on the United Kingdom's major cities. The Germans aimed to weaken the morale of the British people and force the country to surrender. London became the chief target of the Blitz, as the attack was known. The word *blitz* comes from the German word *blitzkrieg* (lightning war).



The Mansell Collection

During World War II, German bombs destroyed much of London. The worst air attacks came in late 1940 and early 1941. Prime Minister Winston Churchill, *front,* inspects the ruins after a raid.

The Blitz lasted from September 1940 to May 1941. Night after night, German planes dropped tons of bombs on London. The City and the industrial East End were especially hard-hit. People took refuge in air-raid shelters and subway stations as fires raged through whole blocks of buildings.

The air attacks on London continued throughout the war but not so savagely as during the Blitz. When Germany surrendered on May 7, 1945, much of London lay in ruins. Historians estimate that from 15,000 to 50,000 Londoners were killed. Bombs had destroyed or damaged about 80 percent of the houses in some parts of London. Bombs had also destroyed many churches and damaged such landmarks as the House of Commons, the Guildhall, and the Inns of Court.

Rebuilding. Before the war, city planners had proposed that a wide band of open country, a Green Belt, be created around London. A plan drawn up during the war called for towns to be built outside the Green Belt. The plan also called for rebuilding of heavily bombed areas and development of the South Bank. Planners cleared part of the South Bank to provide exhibition space for the Festival of Britain in 1951. The festival celebrated the United Kingdom's recovery from the war.

In the 1960's, skyscrapers began to appear in central London, changing the skyline dramatically. The 26-story Shell Centre, the British headquarters of the Royal Dutch/Shell Group, opened in 1962. In 1965, the 620-foot (189-meter) Post Office Tower (now called the BT Tower) was built. At that time, it was the tallest structure in the United Kingdom.

As London built upward, it also continued to spread outward. The London Government Act, passed by Parliament in 1963, replaced the County of London with Greater London. It also divided Greater London into 32 boroughs and created the Greater London Council. The act took effect on April 1, 1965.

Dealing with problems. In the last half of the 1900's, London faced many of the same problems that troubled other large cities. These problems included air pollution, housing shortages, traffic jams, and unemployment and other economic difficulties.

Joint efforts by the central government and local authorities helped clean up London's polluted air. London was long noted for its smog, caused mainly by smoke from houses and industries. A terrible smog in 1952 killed about 4,000 Londoners. Parliament passed Clean Air acts in 1956 and 1968, which limited use of smoke-producing fuels in London and resulted in cleaner air.

The new towns outside the Green Belt helped ease a housing shortage in London. The London area has 8 officially designated new towns, with a total population of about 500,000. Also, housing projects in inner boroughs cleared out many crowded areas and provided new low-cost housing for many families.

To relieve some of the traffic problems, the government built a *motorway* (road) that circles London. The M25 was completed in 1986. It, too, became crowded during the morning and evening rush hours.

Manufacturing employment declined sharply in the 1980's. London lost about half of its manufacturing jobs because companies closed or moved out of London.

Older industrial areas north and east of the City experienced decline. Unemployment began to rise in London as well as throughout the United Kingdom.

But also in the 1980's, a public agency, the London Docklands Development Corporation, began to improve an area of abandoned docks called the Docklands in the East End. The corporation was set up by the government, and it existed from 1981 to 1998. Its goal was to attract new businesses and residents to the Docklands. The redeveloped area included homes, offices, shops, schools, community facilities, new and improved roads, and an airport. The Docklands Light Railway opened in 1987 to help supply public transportation to the area.

Private developers constructed a major new office district at Canary Wharf in the Docklands. The Canary Wharf project included plans for more than two dozen buildings to house residences, offices, hotels, restaurants, shops, and other facilities. Completion of the project was delayed, however. The Canary Wharf developers experienced financial difficulties when a worldwide economic recession helped cause a slump in the London real-estate market.

The Local Government Act of 1985, passed by Parliament, abolished the Greater London Council, which had served as the city's central authority. The act transferred most of the council's responsibilities to the borough governments and the government of the City of London. It took effect on April 1, 1986.

By the end of the 1900's, air pollution caused by automobiles had become a serious problem. Auto emissions caused the London smog to return in a different form. Shortages of low-cost housing continued, and the number of homeless people had increased. The countryside around London had begun to suffer from overcrowding and pollution. City authorities supported more housing construction in London to discourage people from moving to the countryside.

The London economy began to improve in the late 1990's, however. Employment increased, and the real-estate slump appeared to end. The Canary Wharf developers began a new phase of construction, which included apartments, restaurants, and a hotel.

Recent developments. In a 1998 referendum, London voters approved the establishment of the Greater London Authority, a central governing body to replace the Greater London Council that had been abolished in 1985. In 2000, voters elected a mayor and a 25-member assembly, which, together, form the Greater London Authority. Andrew Church

Related articles in *World Book* include:

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VII. History

Questions

When does the ceremony Trooping the Colour take place?
Who rebuilt many of the structures that were destroyed in the Great Fire of London in 1666?
Which river flows through the heart of London?
What is a *cockney?*
When did Roman control of London end?
Where is the Jewel House?
How did the growth of *container shipping* in the 1960's affect London?
What is the oldest part of London?
What is the most popular sport in London?
How long did the Blitz last?

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London, Ontario (pop. 336,539; met. area pop. 432,451), is a distributing, financial, manufacturing, medical, and transportation center in the southern part of the province. It lies on the Thames River (see **Ontario** [political map]). London is nicknamed the *Forest City.*

City Hall and a concert and convention building called Centennial Hall stand in Civic Square. Springbank Park, the city's chief tourist attraction, lies along the Thames River. The park includes Storybook Gardens, a children's amusement center. Eldon House, a home built in the 1830's, also attracts visitors. A symphony orchestra called Orchestra London and a drama group called the Grand Theatre perform in the city. London is the home of the University of Western Ontario.

London has more than 400 manufacturing plants. The chief products include automotive parts, beverages, chemical and electrical products, clothing, diesel vehicles, foods, and telephone equipment. Printing is also a major industry. London Airport lies just outside the city.

London was founded in 1793 by John Graves Simcoe, the first lieutenant governor of Upper Canada. Indians then lived in the area. British settlers came to the area in 1826. They chose the site because of its riverside location and rich farmland. The settlers named the town for London, England. Years before, the river had been named for the River Thames, which flows through the English city. London became a trading center for the surrounding agricultural region. A fire destroyed most of London in 1845, but the people soon rebuilt their town. Railroads built in the 1850's linked London with other Canadian communities and helped bring industry to the area. London was incorporated as a city in 1855. It had a population of about 12,000 that year.

London served as an oil refining center during the 1860's and 1870's. But all the oil companies moved their headquarters to Petrolia, Ontario, during the 1880's. In 1910, London became one of the first cities to receive power from hydroelectric plants at Niagara Falls. This power helped its industries grow.

The city's population increased steadily as a result of the industrial development. It reached 60,959 in 1921 and grew to 169,569 by 1961. By 2001, London had a population of 336,539.

A rebuilding program began in downtown London in the 1960's. Centennial Hall was completed in 1967, City Hall in 1971, and a courthouse in 1974. London City Centre, a hotel and office complex, was completed in 1975. In 1989, an entire city block was developed into an enclosed shopping mall. In 1993, London annexed the nearby town of Westminster and other land, increasing its size from 64 square miles (163 square kilometers) to 166 square miles (422 square kilometers). London is the seat of Middlesex County and has a mayor-council form of government. Donald G. Cartwright

London, Jack (1876-1916), was an American author, journalist, and political activist. He became the most widely read American author. Much of London's fiction can be read as juvenile adventure stories. But his best work also dealt with complex adult themes.

John Griffith London was born on Jan. 12, 1876, in San Francisco. His childhood was marked by emotional and economic deprivation. Between the ages of 16 and 19, he held many jobs connected with the sea. In 1897, London traveled to Canada to seek his fortune in the gold rush in the Yukon Territory. The trip to the Klondike region of the Yukon was a major turning point in London's life. He found materials there that would allow him to express his major literary theme, the struggle for survival of strong men driven by primitive emotions. London's first Klondike stories, collected in *The Son of the Wolf* (1900), made him a best-selling author.

London was fascinated with *environmental determinism,* which states that the world shapes us in ways we are powerless to resist. This is the theme of London's two great animal novels. *The Call of the Wild* (1903) describes the adventures of Buck, a dog taken from California to the Yukon. Buck learns to be brutal in order to survive. *White Fang* (1906) reverses the story. It portrays a wolf who, through the power of a human master's love and kindness, turns from a savage beast into a loyal domestic animal. Among London's other major novels are two that portray strong, brutal men who scorn conventional social attitudes—*The Sea Wolf* (1904) and the autobiographical *Martin Eden* (1909). In these and many other novels and essays, London attacked capitalism. His understanding and sympathy for the poor are strong elements in such works as *The People of the Abyss* (1903), a journalistic report on the poor and homeless living in London, England.



Brown Bros.

Jack London

London's life and work were filled with contradictions. He upheld a socialist ideal of collectivism, but he also held a cruelly individualistic notion of the survival of the fittest. He praised democracy, but he saw his own success as illustrating the rightness of the concept of the superman who stands above ordinary humanity and prevails by force of will. This philosophy had been developed by German philosopher Friedrich Nietzsche. London advocated brotherhood, but he believed that people of the "Anglo-Saxon" or "Teutonic" races were superior to "colored" people. Daniel Mark Fogel

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London, Treaties of. Throughout history, many international treaties have been signed in London. Some of them are described in this article.

The Treaty of 1839 made the Netherlands recognize Belgium's independence and declared Belgium neutral. The United Kingdom, Austria, France, Prussia, and Russia signed the treaty as sponsors. Germany's invasion of neutral Belgium in 1914 caused the United Kingdom to enter World War I (1914-1918).

The Treaty of 1913 attempted to end the First Balkan War (1912-1913). Greece, Serbia, Bulgaria, and their enemy, the Ottoman Empire, signed the treaty on May 30, 1913. The defeated Ottomans were allowed to keep a small European foothold in eastern Thrace. Greece re-

ceived Thessaloniki, southern Macedonia, and Crete. Serbia gained central and northern Macedonia, and Bulgaria took western Thrace and the northern coast of the Aegean Sea. The treaty caused new conflicts. On June 29, 1913, Bulgaria attacked Greece and Serbia, and the Second Balkan War began. See **Balkans**.

The Treaty of 1915 was a secret treaty signed by the United Kingdom, France, Russia, and Italy. In return for entering World War I against Germany, Italy was promised the southern Tyrol, northern Dalmatia, Istria, and Gorizia. See **World War I** (The Italian Front).

The Treaty of 1930 became known as the London Naval Treaty. On April 22, 1930, the United States, France, the United Kingdom, Italy, and Japan signed the pact to limit and reduce naval armaments. The treaty tried to place limitations on cruisers, destroyers, and submarines. It allowed the United States, the United Kingdom, and Japan to increase warship production if another power increased its naval production. France and Italy did not sign part of the treaty.

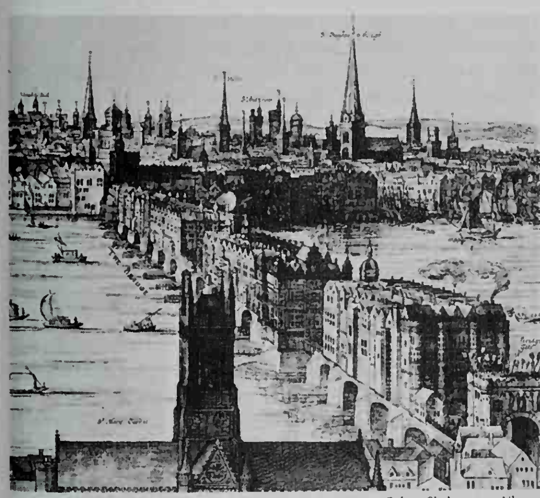
The Treaty of 1936 recertified the naval treaty of 1930. The United States, France, and the United Kingdom signed it on March 25, 1936. Erik Goldstein

London, University of, is the largest traditional university in the United Kingdom. Only the British Open University, which offers instruction mainly through radio, television, correspondence, audiotapes, and videocassettes, has more students. The University of London consists of 30 schools, each controlled by its own governing body, and 10 institutes established by the university government, as well as 5 institutions with teachers approved by the university. These schools and institutes include the Courtauld Institute of Art, the London School of Economics and Political Science, St. Bartholomew's Hospital Medical College, the School of Oriental and African Studies, and University College.

The University of London was founded in 1836. In 1878, it became the first British university to grant degrees to women. P. A. McGinley

London Bridge is one of 15 bridges in London that span the River Thames. Construction of the bridge began in 1967 and was completed in 1973. For location, see **London** (map). The bridge replaced the famous London Bridge that was built between 1823 and 1831. Workers began dismantling the older bridge in 1967 because it was settling into the river and cracks were developing. The bridge was reconstructed in Lake Havasu City, Arizona, (see **Arizona** [Places to visit]).

The first London Bridge was a wooden one built by the Romans. The bridge was rebuilt several times until the first stone bridge was completed in 1209. The famous nursery rhyme "London Bridge" was written about the stone bridge. Houses lined both sides of the bridge, and the heads of executed traitors sometimes hung over the entrance. It was the only bridge over the Thames until 1750. Repairs kept the bridge in use until it was torn down about 1832. John Gillingham



Folger Shakespeare Library

Old London Bridge, shown in this engraving by Visscher, was the only bridge across the River Thames between 1209 and 1750.

London Company was an association of "noblemen, gentlemen, and merchants" during the early days of the American Colonies. It was part of the Virginia Company. In 1606, King James I of England chartered the London Company to form a colony in North America. It founded the Jamestown colony in 1607.

The founders of the London Company believed that precious metals existed in the Americas. They spent about $10,000 to send settlers to Jamestown. Those who went to America and risked their lives were called *planters*. Those who stayed in England and invested their money in the company were called *adventurers*. Each planter and adventurer was to share in the company's profits. But the company failed to profit. The company reorganized under new charters in 1609, and again in 1612. But still there were no profits.

The House of Burgesses was formed in Jamestown in 1619. It was the first representative legislative body in the American Colonies. The House passed measures designed to help the company prosper. But a serious Indian uprising in Jamestown in 1622 caused the adventurers to lose what little interest they had left.

In 1623, King James decided that the company was being managed poorly. He took over the association in 1624 and dissolved the company. Marshall Smelser

See also **Jamestown; Virginia** (History).

Londonderry, *LUHN duhn DEHR ee* (pop. 95,300), is Northern Ireland's second largest city. Only Belfast has more people. This seaport lies 64 miles (103 kilometers) northwest of Belfast (see **Northern Ireland** [map]). It is on a hill overlooking the Foyle River. A wall, 1 mile (1.6 kilometers) long, was built in 1609. It helped in defending Londonderry against James II in 1689. But modern Londonderry has spread far beyond the wall. Its chief industries include brewing, tanning, and linen making. Londonderry has an excellent harbor, and is a center of sea trade with Great Britain and coastal cities of Northern Ireland. It was the site of serious rioting about civil rights in the late 1960's and early 1970's. See also **Northern Ireland** (The civil rights movement). A. T. Q. Stewart

Lone Star State. See Texas.

Long is the name of the most powerful political family in Louisiana history. The Longs—all Democrats—have had great influence in both Louisiana and national politics since the late 1920's.

Huey Pierce Long (1893-1935) began the family's political rule. He had been a farm boy with little formal education beyond high school, but he became governor

of Louisiana and a United States senator. Long, nicknamed the "Kingfish," gained high office by calling for social reforms to benefit poor farmers and workers. He adopted the slogan "Every Man a King."



© Hulton Archive/Getty Images
Huey Long

Long was born on Aug. 30, 1893, near Winnfield, Louisiana. He passed the Louisiana bar exam after studying law briefly at Tulane University. He was elected governor in 1928. As governor, he built roads and hospitals, provided free schoolbooks, and established night schools for adults. In 1929, the Louisiana House of Representatives voted to impeach Long on the charge of misusing state funds. The state Senate acquitted him.

Long was elected to the U.S. Senate in 1930. He refused to resign as governor until 1932, when his handpicked successor was elected to the office and began to carry out Long's programs according to his orders.

At first, Long supported President Franklin D. Roosevelt. But after Long failed in an attempt to make the New Deal more radical in its economic policies, he bitterly attacked Roosevelt. In 1934, Long organized the Share-the-Wealth Society. The organization promised homestead allowances and a minimum annual income for every American family. The society's plan gained Long a national following, and in 1935 he became a candidate for president. Long's candidacy threatened to split the Democratic Party.

But Long was shot on Sept. 8, 1935, in the State Capitol in Baton Rouge. Louisiana officials concluded that Long's assassin was Carl A. Weiss, a physician. Members of Weiss's family were political enemies of Long. However, some experts doubt that Weiss was the assassin. Long's bodyguards killed Weiss immediately after Long was shot. Long died two days later. His widow, Rose McConnell Long, completed his Senate term. Long told of his rise to power in his autobiography, *Every Man a King* (1933). A statue of Long represents Louisiana in Statuary Hall in the United States Capitol.

See also **Louisiana** (picture: Governor Huey P. Long).

Russell Billiu Long (1918-   ), son of Huey Long, served in the U.S. Senate from 1948 to 1987. From 1966 to 1981, he served as chairman of the Senate Finance Committee. In that post, Long was a shrewd leader who greatly influenced the nation's taxes, Social Security, and welfare programs. He favored simplified tax returns, a heavier tax burden on the wealthy, and no change in the oil depletion allowance. Long also served as assistant majority leader of the Senate from 1965 to 1969. He was born on Nov. 3, 1918, in Shreveport, Louisiana.

Earl Kemp Long (1895-1960), younger brother of Huey Long, served three times as governor of Louisiana—in 1939 and 1940, from 1948 to 1952, and from 1956 to 1960. He was elected to the U.S. House of Representatives 10 days before he died. Earl and Huey became political foes in 1932 after Huey refused to name Earl as his organization's candidate for lieutenant governor. Earl Long was born on Aug. 26, 1895, near Winnfield, Louisiana.

George Shannon Long (1883-1958), older brother of Huey Long, was the representative of a rural Louisiana district in the United States House of Representatives from 1953 until his death. He was born on Sept. 11, 1883, near Winnfield, Louisiana. Charles Bartlett

Long, Crawford Williamson (1815-1878), became, in 1842, the first doctor to use ether as an anesthetic for surgery. Ether's anesthetic properties had been demonstrated at "ether frolics," during which people took small amounts of ether to experience its strange effects. On March 30, 1842, Long gave ether to James Venable and then painlessly removed a tumor from Venable's neck. Long did not announce his experiment, and it received no publicity. Long remained unaware of the full value of anesthesia in surgery, though he continued to make occasional use of ether. Finally, in 1849, he published a description of his experiments with ether.

Meanwhile, in the mid-1840's, William T. G. Morton, a Boston dentist, used ether on a patient before extracting a tooth. This had been performed at the suggestion of Charles T. Jackson, a professor of chemistry at Harvard University. Morton's use of ether became widely known in 1846, after he administered it during a surgery at the Massachusetts General Hospital. Morton and Jackson each claimed sole credit for the discovery of ether anesthesia. But today, most historians give the credit to Long.

Long was born on Nov. 15, 1815, in Danielsville, Georgia. He graduated from the Medical School of the University of Pennsylvania. The Crawford W. Long Medical Museum in Jefferson, Georgia, exhibits some of his papers and early anesthesia equipment. A statue of Long represents Georgia in the U.S. Capitol. Edwin S. Munson

See also **Anesthesia; Ether; Morton, William T. G.**

Long, Jane (1798-1880), was called the *Mother of Texas* because of her spirited defense of her children during pioneer days. During the winter of 1821-1822, her husband, James, left their home to fight for Texas's independence. He assigned soldiers to guard his wife and baby, but the soldiers left when Long failed to return. Mrs. Long's only helper was a servant girl, who became ill. Mrs. Long and her family survived the winter, but she had to fight off Indians, hunt for food, and give birth to another baby. Her husband was murdered in Mexico, but she stayed in Texas. She was born July 23, 1798, in Charles County, Maryland, Joseph A. Stout, Jr.

Long, Stephen Harriman (1784-1864), was an American explorer and railroad engineer. Early in his career, as an Army officer, Long had numerous maps made for the government and gave it valuable information about the West. Between 1817 and 1823, he led Army expeditions to the upper Mississippi River area, the Rocky Mountains, the source of St. Peter's River in Minnesota, and the boundary of the United States in the Great Lakes region.

Long established Fort Smith, now an Arkansas city, in 1817. In 1820, he discovered the mountain near Denver now known as Longs Peak. From 1827 to 1830, Long helped select and survey the route of the Baltimore and Ohio Railroad. He was chief engineer of the Atlantic and Great Western Railroad from 1837 to 1840. He also designed railroad bridges. Long was born on Dec. 30, 1784, in Hopkinton, New Hampshire. Monte A. Calvert

Long Beach (pop. 461,522) is a major industrial center and seaport in southern California, near Los Angeles. Long Beach and Los Angeles form part of a metropolitan area that has a population of 9,519,338. Long Beach lies along San Pedro Bay, 20 miles (32 kilometers) southeast of Los Angeles. For the location of Long Beach, see **California** (political map); **Los Angeles** (maps).

Description. Long Beach covers 50 square miles (130 square kilometers), including 14 square miles (36 square kilometers) of inland water. The city has 7 miles (11 kilometers) of beaches. It is the home of California State University, Long Beach. Long Beach City College, one of the largest community colleges in the United States, is in the city. Long Beach's Performing Arts Center is a concert, convention, and exhibition center.

Economy. Leading industries include aircraft and electronics manufacturing, food processing, and oil production. The city is the site of the Wilmington Oil Field, which has produced several billion barrels of oil since its discovery in 1936. Much of the oil is pumped from offshore oil wells. Income from the oil wells goes mostly to the state. However, the city government receives a share of the oil revenue. The Port of Long Beach is one of the busiest ports in the United States.

Long Beach is a leading health care center. The city has six major private hospitals. It also has one of the largest of the hospitals operated by the United States Department of Veterans Affairs.

Long Beach is also a tourist center. Its attractions include the Aquarium of the Pacific and the ocean liner *Queen Mary,* which is permanently docked there.

History. Shoshone Indians lived in what is now the Long Beach area before European settlers arrived there. The area consisted chiefly of ranchland until the mid-1880's, when railroads linked the Midwest and southern California. The railroads brought thousands of settlers there, and a group of land investors founded Long Beach in 1888. The town was incorporated as a city in 1897, when it had a population of about 1,700.

Long Beach developed as a resort city because of its beaches and warm climate. In 1921, oil was found in Signal Hill, now a small city surrounded by Long Beach. The discovery drew so many people to the area that the population of Long Beach rose from 55,593 in 1920 to 142,032 in 1930. On March 10, 1933, an earthquake in the city killed 52 people and damaged property worth over $40 million.

The Wilmington Oil Field was discovered in 1936. The aircraft industry developed in Long Beach during World War II (1939-1945). The city's population increased from 164,271 in 1940 to 250,767 in 1950, largely because of industrial growth.

During the 1940's, areas of land near the Long Beach harbor began to sink because so much oil had been removed from the ground. In 1958, the city began to pump water into the ground. The resulting water pressure has prevented further sinkage.

A number of new buildings were constructed in Long Beach in the 1980's and 1990's as part of a major redevelopment of the downtown area. A civic center that features city, county, and state offices was built. Commercial and residential structures, high-rise office buildings, hotels, and a shopping mall also were completed. The population of Long Beach continued to grow rapidly, rising from 361,355 in 1980 to 461,522 in 2000. In 1997, the Long Beach Naval Station, which had been established in 1942, was closed. Long Beach has a council-manager form of government. Kenneth Reich

Long division. See **Division.**

Long Island (pop. 7,448,618) is an island that forms the southeastern part of New York. It consists of crowded urban areas, large suburban areas, and smaller residential towns. Farms, fishing villages, and resort centers lie toward the eastern part. A section of western Long Island forms part of New York City. The early Indian residents called the island *Paumanok,* an Algonquian word that means *fish-shaped.*

Location and size. Long Island extends eastward from the Narrows in New York Bay for about 120 miles (190 kilometers). For the location of Long Island, see **New York** (political map). Long Island covers 1,701 square miles (4,406 square kilometers) and is the largest island in area off the mainland United States. The island divides at its eastern end into two narrow peninsulas. One peninsula, the North Fork, is about 25 miles (40 kilometers) long. The other peninsula, the South Fork, is 40 miles (65 kilometers) long.

Along most of its southern shore, the island is protected from the ocean by many barrier beaches. These beaches include Fire Island National Seashore, Jones Beach, Long Beach, and Westhampton Beach.

The counties. Long Island consists of Kings, Queens, Nassau, and Suffolk counties. Kings County (Brooklyn) and Queens County form a major part of New York City.

Long Island has a varied economy. Economic activities include banking, biotechnology, and electronics. Deep-sea fishing and tourism are also important economic activities. Farming and winemaking generate income in Suffolk County. Farms and vineyards are located in the northeastern part of the county. The Brookhaven National Laboratory in Suffolk is a center for scientific research. Suffolk is also known for the beaches of the Hamptons.

History. The explorer Henry Hudson reached Long Island in 1609. Later during the 1600's, the Dutch settled in the western end of the island, and New Englanders settled in the eastern part.

One of the most important battles of the Revolutionary War in America, the Battle of Long Island, took place in present-day Brooklyn on Aug. 27, 1776. There, the British forces defeated the Americans, but the colonial troops escaped.

The island became a residential area in the early 1840's, after a railroad was built along its northern shore.



WORLD BOOK map

Location of Long Island

By the early 1900's, fabulous mansions had been constructed in Nassau. Long Island experienced rapid growth after highways were built in the mid-1900's. Between 1940 and 1960, Nassau County's population tripled, while that of Suffolk County quadrupled.

Debra A. Willett

See also **Long Island Sound; New York City.**

Long Island Sound is a busy waterway that extends southwest between Connecticut and Long Island. This arm of the Atlantic Ocean is nearly 110 miles (177 kilometers) long. It is 21 miles (34 kilometers) wide at its widest point. The sound narrows to a width of $\frac{2}{3}$ mile (1.1 kilometers) at its west end, where it meets the East River. The East River connects the sound with New York Bay.

Michael K. Heiman

Long jump is a track and field contest in which athletes compete to see who can jump the farthest. The long jump may be a men's or women's event.

In the long jump, the athlete runs down a runway to the take-off point, usually a wooden board, 8 inches (20 centimeters) wide. The athlete then tries to jump as far as possible into a sand-filled pit. The jump is measured from the edge of the board nearest the pit, called the *take-off line,* to the mark in the sand nearest the board. If any part of the jumper's foot goes past the take-off line as he or she jumps, the attempt is a foul. In most competitions, an athlete gets six attempts. Results are determined by each entrant's farthest fair jump. Jumpers try to get the legs and feet in front of the body at the landing to maximize the distance. Michael Takaha

See also **Track and field** (Jumping events; tables); **Olympic Games** (table: Track and field).

Long Parliament refers to a session of the English Parliament that lasted without a break from 1640 to 1653. It was not formally dismissed until 1660. The Long Parliament opened with a direct conflict with King Charles I. It met during the English Civil War in the 1640's, ordered the king's execution in 1649, and tried to rule in the uneasy years after the war. It was finally dismissed to make way for a new Parliament under King Charles II.

In its early sessions, the Long Parliament made many lasting political reforms. It abolished courts controlled by the monarchy, including the Star Chamber and the Court of Requests. It declared that the king could neither collect money nor dismiss Parliament without its consent. It also brought about the execution of Charles's chief advisers, the Earl of Strafford and Archbishop William Laud.

On religious questions, the Long Parliament was seriously divided. Presbyterians opposed Puritans, and neither side would budge. Civil war began when the king's supporters withdrew from Parliament, and the House of Commons soon became divided into Presbyterians, who were moderate supporters of the king, and Independents, who favored strong controls on the crown. The army, under Oliver Cromwell, supported the Independents. In 1648, an army detachment under Colonel Thomas Pride kept the Presbyterian majority from entering the House. "Pride's Purge" resulted in what was called "the Rump Parliament," which had less than a fifth of the usual number of members. This remainder of the Long Parliament carried out the execution of Charles I, and it made England a commonwealth.

Cromwell, the real power in the commonwealth, was unable to work with the Rump Parliament, and he suppressed it in 1653. However, he could not replace the Rump Parliament with an efficient legislature. In 1660, two years after Cromwell's death, political chaos in England forced the army under General George Monck to intervene. Monck persuaded a newly elected Parliament to invite Prince Charles Stuart to become King Charles II. Charles accepted, and the monarchy was restored.

Charles Carlton

See also **Charles I** (of England); **Cromwell, Oliver; England** (The Civil War); **Rump Parliament; Star Chamber.**

Longbow. See **Archery** (History).

Longevity, or *Length of life.* See **Life expectancy.**

Longfellow, Henry Wadsworth (1807-1882), was the most widely published and most famous American poet of the 1800's. His reputation among critics declined sharply after his death, and he had much less influence on modern poetry than such other poets of his day as Walt Whitman and Emily Dickinson. However, many of his poems remain among the most familiar in American literature.

Longfellow's best-known longer works include *Evangeline, The Song of Hiawatha,* and *The Courtship of Miles Standish.* Among his popular shorter poems are "The Village Blacksmith," "The Children's Hour," "Paul Revere's Ride," "The Wreck of the Hesperus," and "Excelsior." Longfellow's works achieved great popularity in Europe as well as in the United States. He was the first American writer to be honored in the Poets' Corner of Westminster Abbey in London.

Longfellow's life

Early years. Longfellow was born on Feb. 27, 1807, in Portland, in what is now Maine. The area was then part



A sketch by Franquinet. The Longfellow House, Cambridge, Massachusetts

Longfellow in 1839 published his first collection of poems, *Voices of the Night.* He was then a young professor at Harvard.

of Massachusetts. His mother, Zilpah Wadsworth Longfellow, was the daughter of Peleg Wadsworth, a Revolutionary War general. Henry's father, Stephen Longfellow, was a lawyer.

Growing up in Portland, a seaport, gave Longfellow a love of the ocean that would influence his writing throughout his life. A Portland newspaper published Longfellow's first poem when he was 13.

Longfellow was admitted to Bowdoin College in Brunswick, Me., at age 15. One of his classmates was Nathaniel Hawthorne, who became a famous writer. While attending Bowdoin, both men decided to pursue careers as writers. In a letter to his father, Longfellow wrote, "I most eagerly aspire after future eminence in literature."

Professor and family man. In college, Longfellow showed his skill at learning other languages. After Longfellow graduated at the age of 18, he accepted a position as the college's first professor of modern languages. First, however, he agreed to study in Europe, where he mastered French, Spanish, and Italian, and began to learn German.

In the fall of 1829, after more than three years of study, Longfellow returned to Bowdoin to take up his new position. He had to create his own textbooks because the study of modern languages was a new field. Longfellow composed almost no poetry for the next 10 years. Instead, he concentrated on scholarly writing, teaching, translating, and prose writing.

In 1831, Longfellow married Mary Storer Potter. In 1834, he was offered a new position as Smith professor of modern languages at Harvard College. To prepare himself, Longfellow had to study German literature and language in Europe. In 1835, the couple traveled to England, Sweden, Denmark, and the Netherlands. In the Netherlands, his wife suffered a miscarriage and died shortly afterward in Rotterdam on Nov. 29, 1835.

Longfellow began teaching at Harvard in 1837. Two years earlier, his first book, *Outre-Mer: A Pilgrimage Beyond the Sea,* had been published. It was a collection of European travel sketches modeled on the *Sketch Book* (1819-1820), by the American author Washington Irving. A second prose work, the partly autobiographical novel *Hyperion* (1839), also drew on Longfellow's travels in Europe.

Longfellow's first volume of poems, *Voices of the Night,* also appeared in 1839. A second collection of poetry, *Ballads and Other Poems* (1841), contained several works that helped make Longfellow well known. These included "The Wreck of the Hesperus," "The Village Blacksmith," and "Excelsior."

In 1842, Longfellow traveled in Europe for six months. After his return, he published *Poems on Slavery* (1842), which described his opposition to slavery. In 1842, Frances (Fanny) Appleton accepted Longfellow's marriage proposal, following a seven-year courtship. The couple were married in July 1843. They had six children and enjoyed 18 years of great happiness.

Longfellow had been a boarder at Craigie House in Cambridge, Mass., since 1837. After his marriage to Frances, her wealthy father bought the house as a wedding gift for the couple. Throughout their marriage, Longfellow and Frances lived in the historic house (now called Longfellow House). As Longfellow's reputation grew over the years, hundreds of visitors, both famous and unknown, called on the famous poet. The house and grounds now make up the Longfellow National Historic Site.



A drawing by S. W. Rowse. The Longfellow House, Cambridge, Mass.

The Longfellow House, Cambridge, Mass.



Longfellow in 1869, *right,* posed for this photograph with members of his family in Florence, Italy. His second wife, Frances Appleton, *above,* died in a fire in 1861. This great tragedy in Longfellow's life inspired perhaps his finest poem, "The Cross of Snow."



National Park Service

Longfellow House, in Cambridge, Mass., was Longfellow's home from 1843 until his death in 1882. The mansion, once called Craigie House, was built in 1759. It served as a headquarters for George Washington during the Revolutionary War.

Author and world celebrity. Longfellow published his next book of poems, *The Belfry of Bruges and Other Poems,* in 1845. The book included two antiwar poems, "The Arsenal at Springfield" and "The Occultation of Orion." *Evangeline: A Tale of Acadie* (1847) established Longfellow as the most popular writer of narrative poetry of his time. He then published his final work of prose fiction, *Kavanagh: A Tale* (1849), about life in a small New England town.

In 1850, Longfellow published another collection of poems, *The Seaside and the Fireside.* The title indicates two of the settings that conveyed some of the author's most characteristic themes, the sea and the family circle. This volume contains "The Building of the Ship," which draws on Longfellow's familiarity with shipbuilding in Maine for its primary subject matter. The newly built ship symbolizes the nation, especially in the final stanza, which begins with the lines "Thou, too, sail on, O Ship of State! / Sail on, O Union, strong and great!" A decade later, President Abraham Lincoln was deeply moved by these lines.

In 1854, Longfellow left Harvard to devote full time to writing poetry. The next seven years were the most productive of his career. *Evangeline* had revealed Longfellow's special ability in writing long narrative poems. He returned to this type of work successfully three more times—in *The Song of Hiawatha* (1855), *The Courtship of Miles Standish* (1858), and *Tales of a Wayside Inn* (1863, 1872, 1873). Longfellow's verse was translated into many languages, and he became known throughout the Western world.

Tragedy struck Longfellow again on July 9, 1861. His wife, Frances, accidentally set her dress afire. Frances was fatally burned despite Longfellow's efforts to smother the fire with his hands and a rug. Frances was buried on the 18th anniversary of her marriage to Longfellow. However, Longfellow was too badly burned and grief-stricken to attend his wife's funeral.

It was 18 years later and just three years before his own death that Longfellow wrote "The Cross of Snow." "The Cross of Snow" was a *sonnet* (14-line poem) about Frances that some critics consider Longfellow's best work:

In the long, sleepless watches of the night,
A gentle face—the face of one long dead—
Looks at me from the wall, where round its head
The night-lamp casts a halo of pale light.
Here in this room she died; and soul more white
Never through martyrdom of fire was led
To its repose; nor can in books be read
The legend of a life more benedight.
There is a mountain in the distant West
That, sun-defying, in its deep ravines
Displays a cross of snow upon its side.
Such is the cross I wear upon my breast
These eighteen years, through all the changing scenes
And seasons, changeless since the day she died.

By 1868, when he took another trip abroad, Longfellow was known as "the grand old man of American letters." While in England, he received honorary degrees from Oxford and Cambridge universities, and was granted private meetings with Queen Victoria and Prince Albert. Longfellow died in Craigie House on March 24, 1882.

Longfellow's works

Narrative poems. In 1847, Longfellow published *Evangeline,* the first of his four major narrative poems. The poem is based on the forced removal of French settlers from Nova Scotia by the British during the French and Indian War (1754-1763). Two lovers, Gabriel Lajeunesse and Evangeline Bellefontaine, are separated as a result of the removal. The poem describes the lifelong devotion of Evangeline as she searches for Gabriel for many years, finally finding him in old age, dying of the plague. The poem played on the then popular appeal of sentimental love stories and of depictions of the American landscape.

Longfellow's *The Song of Hiawatha,* published in 1855, was the second of his major narrative poems. In this poem, Longfellow captured the humanity and nobility he saw in American Indians. *The Song of Hiawatha* focused on an Indian hero named Hiawatha, whose life, like that of his people, is full of triumphs and tragedies. The poem ends with the death of Hiawatha's wife, Minnehaha, the coming of the white man, and his own symbolic departure into the sunset in his canoe. In the poem, Longfellow presented the Indians' mythology, which he had read about in the writings of the experts of the day.

Longfellow's *The Courtship of Miles Standish,* published in 1858, was his third major narrative poem. It is one of several Longfellow poems that deals with the early history of New England. The poet used unrhymed *hexameters* (six poetic feet in every line), as he had done in *Evangeline.* But in *The Courtship of Miles Standish,* the *meter* (rhythm) is looser.

The poem tells of a love triangle involving Miles Standish, Priscilla Mullins, and John Alden. Standish is too proud to ask Priscilla to marry him, and asks Alden to propose for him. Priscilla asks Alden why he is acting

for Standish, rather than speaking for himself. Alden and Priscilla marry and are eventually reunited in friendship with Standish.

The strengths of *The Courtship of Miles Standish* are in its characterizations and its depictions of the American landscape. The work portrays the beginnings of American civilization for an audience inclined to have great respect for those origins.

In *Tales of a Wayside Inn,* the fourth of Longfellow's major narrative works, the poet wrote a series of 22 stories in verse told by seven men gathered at an inn in "Sudbury Town" in Massachusetts. Longfellow began writing *Tales of a Wayside Inn* before Frances's death, but he put it aside temporarily in his grief. His inspiration for *Tales of a Wayside Inn* came, in part, from his reading of the story sequences in Geoffrey Chaucer's *Canterbury Tales* and Giovanni Boccaccio's *Decameron.*

Five of Longfellow's tales, including "Paul Revere's Ride," have American settings. The others take place in various other countries, including Italy, Spain, France, and Norway. In the collection, Longfellow effectively combined his storytelling ability with his scholarly knowledge of the narrative traditions of other lands.

Translations, lyric poems, and dramatic poems. Longfellow translated poetry from 18 languages. His most significant translation, published in 1867, was of Dante Alighieri's medieval poem the *Divine Comedy.* Longfellow worked on the translation over a period of several years. A group of writers known as the Dante Club met at Craigie House once a week to offer critical advice on the translation. The group included James Russell Lowell and Charles Eliot Norton.

In the finished work, a pair of Longfellow's original sonnets precedes each of the three major sections of the *Divine Comedy.* The sonnets are among Longfellow's best lyric poems. Some scholars feel Longfellow made the finest translation of the *Divine Comedy* in the English language.

During his later years, Longfellow continued to write sensitive lyric poems. Significant lyric poems from this period in Longfellow's life include "The Wind over the Chimney," "The Tide Rises, The Tide Falls," "Palingenesis," "Kéramos," and "The Chamber over the Gate," and many sonnets, including "The Cross of Snow." Longfellow was the finest American sonnet writer of the 1800's. Several of the important sonnets from his later years deal with such earlier poets as Dante, John Keats, John Milton, Geoffrey Chaucer, and William Shakespeare. Longfellow also wrote many sonnets about the sea, including "The Tides," "The Broken Oar," and "Chimes."

Longfellow also attempted longer dramatic poems in his later years, but generally had little success. Perhaps the most powerful of these is the unfinished work, *Michael Angelo.* In the poem, Longfellow explored the meaning and value of poetry and artistic creativity.

Longfellow's place in literature

To the modern reader, Longfellow's sentimental and optimistic poetry often makes him seem somewhat old-fashioned. In fact, however, he consistently experimented in verse forms from outside the English poetic tradition. He used his extensive knowledge of the literature of other countries as a source for both the form and content of much of his poetry. This added energy to his work and made it more interesting at a time when most poetry had become rather predictable.

Longfellow's lyric and narrative poetry made lasting contributions to the American literary tradition. However, his works have frequently been criticized. During Longfellow's lifetime, the American journalist and literary critic Margaret Fuller called his work "artificial and imitative." Yet Longfellow wrote for the common middle-class reader by using a clear, sometimes elegant style that represented popular American values.

Sargent Bush, Jr.

For quotations from Longfellow's poems, see **December; September.** See also **Hiawatha; Maine** (Places to visit; picture: Wadsworth-Longfellow House).

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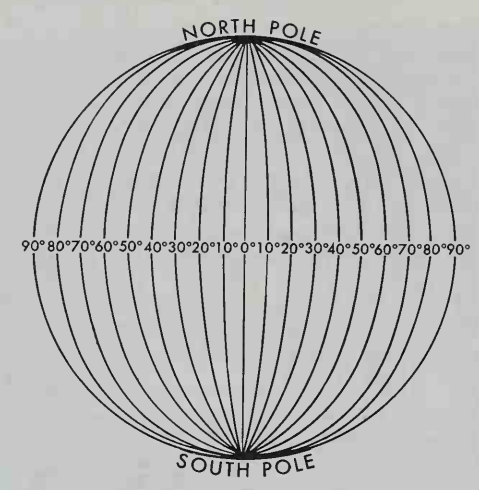
Longinus, *lahn JY nuhs,* is the name given to the unknown author of *On the Sublime,* an ancient Greek *treatise* (long essay) on literary criticism. Many scholars rank it second in importance only to Aristotle's *Poetics* among ancient writings on literature. *On the Sublime* was probably written during the first 100 years after the birth of Jesus Christ.

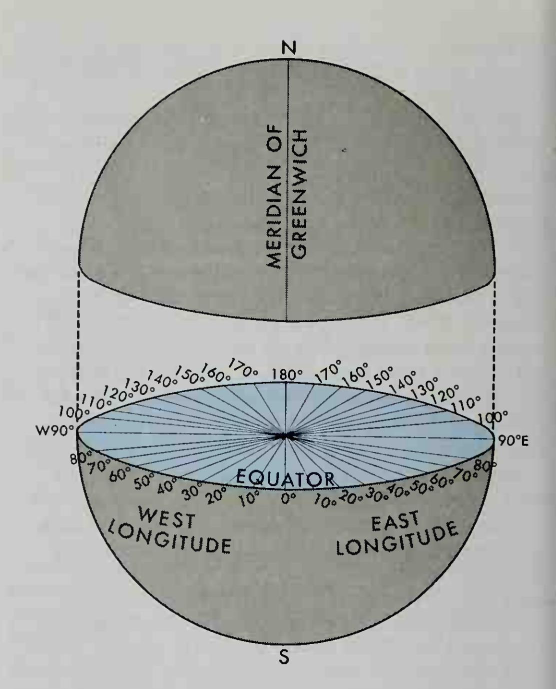
The treatise identifies five sources of sublimity in literature. The author used *sublimity* as another term for *grandeur.* The sources of sublimity are (1) the ability to conceive great thoughts, (2) intense emotion, (3) powerful figures of speech, (4) the choice of noble words, and (5) harmonious composition of sentences. *On the Sublime* compares the literary styles of the Greek orator Demosthenes and the Roman orator Cicero. Its own style is highly sophisticated. Cynthia W. Shelmerdine

Longitude. If one person on the equator travels directly north, and another person 69 miles (111 kilometers) west also travels directly north, their paths will meet at the North Pole. Each person will have traveled in the same direction along a different *line of longitude.* Lines of longitude run north and south along the surface of the earth. Mapmakers think of the earth as a huge globe that is divided into 360 equal slices. The lines between the slices on the outside of the globe are called *meridians.* Meridians are the main lines of longitude on maps.

Longitude and location. Most nations start counting longitude east and west from an imaginary line running through Greenwich, a borough of London. These countries have agreed Greenwich lies at 0° longitude.

The earth is divided into two parts, or hemispheres, of east and west longitude. Each hemisphere has 180 degrees. Degrees of longitude are used to measure east and west distances on maps. They are used, along with degrees of *latitude,* to find certain points (see **Latitude**). For example, New York City lies at 74° west longitude. This means that if a person travels west from Greenwich to New York City and counts the imaginary meridians, New York City would lie on the 74th meridian west of Greenwich. Sailors and pilots use longitude to help determine the location of their ships and airplanes.





Meridians of longitude are lines drawn from north to south on maps and globes to indicate distances and locate points. The prime meridian passes through Greenwich, England, *right.* All meridians of longitude meet at the North and South poles, *above.* The distance between meridians is greatest at the equator. It gradually decreases as the meridians near the poles.

The space between two meridians is greatest at the equator—about 69 miles (111 kilometers). This space narrows as the meridians approach the North and South poles. For example, a degree of longitude at New Orleans is about 60 miles (97 kilometers) wide. At Winnipeg, Canada, which lies much nearer the North Pole, a degree of longitude is less than 45 miles (72 kilometers) wide. At Fairbanks, Alaska, which is still closer to the pole, it is even narrower.

Longitude and time. Any point on the earth's surface traces a whole circle—360 degrees—once every 24 hours. It does this because the earth turns once on its axis every 24 hours. All 360 degrees of the earth's circumference also pass beneath the sun once in 24 hours. In *one* hour, $\frac{1}{24}$ of 360 degrees, or 15 degrees, passes beneath the sun. Because it seems that the sun is moving instead of the earth, people say that one hour of time equals 15 degrees of longitude.

Each degree of longitude is divided into 60 parts called minutes. Each minute is divided into 60 seconds of longitude. One minute is written as 1′, and one second as 1″. These minutes and seconds of longitude measure distance, not time. But since an hour of time equals 15° of longitude, a minute or second of time equals a certain distance that can be expressed in minutes and seconds of longitude.

The following table gives the equivalent in distance for five units of time. These units range from a day to a second:

24 hours of time = 360° of longitude.
1 hour of time = 15° of longitude.
4 minutes of time = 1° of longitude.
1 minute of time = 15′ of longitude.
1 second of time = 15″ of longitude.

Stephen S. Birdsall

See also Map; Time.

Longs Peak. See Colorado (Land regions; map).

Longsightedness. See Farsightedness.

Longstreet, James (1821-1904), was a Confederate general in the Civil War (1861-1865). His troops called him "Old Pete." As a lieutenant general, he commanded the First Corps of General Robert E. Lee's army, and he fought in most of the major battles in Virginia. Not aggressive in battle, Longstreet liked to take a strong position and hold it. This point of view made him the center of a great controversy after the Battle of Gettysburg. According to some students of the battle, Longstreet did not put his heart into Lee's plan of attack. Lee, however, continued to count on Longstreet throughout the Civil War. Longstreet was a dogged combat soldier and an able defensive commander.

Longstreet was born in Edgefield District, South Carolina. He graduated from the United States Military Academy in 1842 and later fought in the Mexican War (1846-1848).

In 1880, Longstreet, who had allied himself with the Republicans, was appointed minister to Turkey. He served as U.S. commissioner of railroads from 1898 until his death in 1904. Steven E. Woodworth

Lookout Mountain, Battle of. See Civil War (Battle of Chattanooga).

Loom. See Weaving; Textile.

Loon is a type of water bird with a sleek body for swimming and diving. Loons have a short tail and webbed feet and look like large ducks when sitting on water. Loons use their dagger-shaped bill to catch fish. They sometimes are called *divers* and can feed in deep water.

There are four species of loons, all of which live in the northern part of the Northern Hemisphere. The *common loon,* also called the *great northern diver,* is found during the summer on secluded lakes and rivers from the Northern United States to the Arctic Circle. It often spends the winter along coastal areas as far south as Texas. It is the state bird of Minnesota. Common loons measure about 30 inches (76 centimeters) long. Their backs and wings are black with white spots. The head

and neck are glossy black and green, and the neck has white streaks. The strange laughing calls of these birds echo over water and gave rise to the saying "crazy as a loon."

The *yellow-billed loon* looks much like the common loon but is somewhat larger. It lives only in the Far North. The *arctic loon* has a purple-black throat. The *red-throated loon* has an upturned bill and dull brown feathers, except for the throat. Eric G. Bolen

Scientific classification. Loons belong to the loon family, Gaviidae. The common loon is *Gavia immer.* The yellow-billed loon is *G. adamsii;* the arctic loon, *G. arctica;* and the red-throated loon, *G. stellata.*

See also **Bird** (picture: Birds of inland waters and marshes).

Looper. See Measuring worm.

Loosestrife is the common name of certain flowering plants in either the primrose family or the loosestrife family. Common species in the primrose family include *garden loosestrife* and *moneywort.* Garden loosestrife has sword-shaped leaves and yellow flowers. Moneywort, also called *creeping Charlie* and *creeping Jennie,* grows as a creeping vine that bears bright yellow blossoms. Both species are native to Europe and Asia and are grown in the United States.

Purple loosestrife is a common species in the loosestrife family. It is a tall plant with purple or reddish flowers. It spreads rapidly and is a troublesome weed in the northeastern and north-central parts of the United States. In some states, it is illegal to plant or sell purple loosestrife. Theodore R. Dudley

Scientific classification. Loosestrifes belong to either the loosestrife family, Lythraceae, or the primrose family, Primulaceae. The scientific name for garden loosestrife is *Lysimachia vulgaris.* Moneywort is *L. nummularia.* Purple loosestrife is *Lythrum salicaria.*

Lope de Vega. See Vega, Lope de.

López, Carlos Antonio and **Francisco Solano.** See **Paraguay** (Independence; Military ruin).

Lopez, Nancy (1957-), became one of the greatest and most popular players in the history of women's golf. Her exciting game and warm personality made Lopez a crowd favorite from the start of her career. Her skill and popularity raised women's professional golf to greater prominence. In 1978, her first full year as a professional, she won nine tournaments, five in succession. She won eight tournaments in 1979.

Lopez was born in Torrance, California, and raised in Roswell, New Mexico. She began learning golf from her father, an amateur player. She won the New Mexico Women's Amateur title at the age of 12. Lopez joined the Ladies Professional Golf Association (LPGA) in 1977. She won Player of the Year honors several times. After gaining the 35th victory of her career in 1987, Lopez was inducted into the LPGA's Hall of Fame. In 1982, she married major league baseball player Ray Knight.

Marino Parascenzo

López de Santa Anna, Antonio. See Santa Anna, Antonio López de.

López Portillo, *LOH pehz pawr TEE yoh,* **José,** *hoh SAY* (1920-), served as president of Mexico from 1976 to 1982. López Portillo, a member of the Institutional Revolutionary Party, ran unopposed in the 1976 presidential election. As president, he supported economic programs to encourage investment in private business in Mexico in order to increase economic growth and employment. Increased oil production at the start of his term helped improve Mexico's economy. But mismanagement of oil revenues, excessive borrowing, and corruption in government led to severe economic problems.

López Portillo was born in Mexico City. He received a law degree from the National Autonomous University of Mexico in 1946. He taught college courses in law, political science, and public administration from 1947 to 1958. In 1959, he became an adviser in the government's Ministry of National Patrimony.

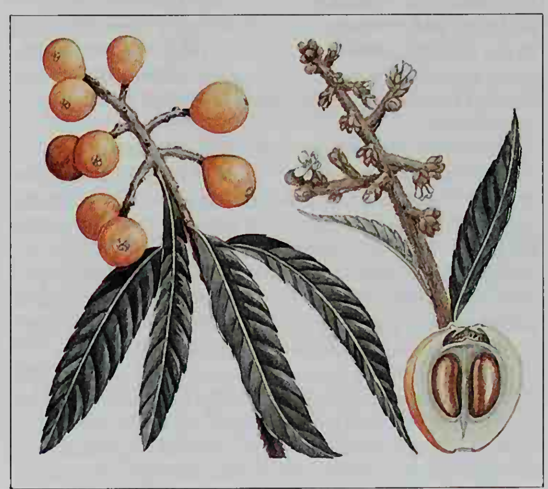
During the 1960's, López Portillo held increasingly important positions in the Mexican government. In 1970, he was named undersecretary of national patrimony. In 1973, López Portillo became secretary of finance and public credit. Roderic A. Camp

Loquat, *LOH kwaht,* is an orange or yellow fruit that has the shape and size of an egg. It is a type of fleshy fruit called a *pome* and contains many seeds inside a papery core.

The loquat tree is an evergreen that grows from 18 to 25 feet (5.5 to 7.6 meters) high. It is grown extensively in Japan. The tree was brought to the United States from China and Japan in 1784. Today, it is grown commercially in California. It also grows along the Gulf Coast and in northern South America.

Loquat fruit is soft and bruises easily when mature. Loquats have a mildly tart flavor. They are eaten fresh, cooked, and as a jelly. George C. Martin

Scientific classification. The loquat tree is in the rose family, Rosaceae. It is *Eriobotrya japonica.*



WORLD BOOK illustration by Kate Lloyd-Jones, Linden Artists Ltd.

Loquats are small egg-shaped fruits with a slightly tart flavor. The fruits grow in clusters on the loquat tree, a small evergreen.

Loran, *LAWR an,* stands for *l*ong *r*ange *n*avigation. It is a system of radio navigation that helps ships and aircraft find their positions. A master station and two or more secondary stations continually send out radio signals. The ship or aircraft receives these signals with special equipment. The equipment measures the time interval

between the pulses that it receives from the stations. The difference in time between receiving the signals from one pair of stations places the ship or the aircraft at some point on a *loran line of position* on a chart. The chart is marked to show the position of the vehicle according to the difference in time between the signals.

In most cases, a single master station is paired with each of two secondary stations. This allows the navigator to *intersect* (cross) two loran lines of position to fix a ship or aircraft's position.

In the United States and Canada, navigators use a system known as loran-C. Loran-C can transmit its signal more than 1,000 miles (1,600 kilometers) during the day. Under certain conditions, it has a range of more than 3,000 miles (4,800 kilometers) at night, when low-frequency radio waves travel farther. A position can be located within approximately $\frac{1}{4}$ mile (0.4 kilometer).

Don R. Kozlowski

See also **Navigation** (Electronic navigation).

Lorca, Federico García. See **García Lorca, Federico.**

Lord is a title added to a person's name or to his office. The United Kingdom's House of Lords includes the peers, called *Lords Temporal,* and dignitaries of the Church of England, called *Lords Spiritual.* The word *lord* is frequently used as a less formal title for a marquess, earl, or viscount, and always for a baron. The younger sons of dukes and marquesses have the title added to their names. The word *lord* is also used with the names of bishops (the Lord Bishop of London) and government offices (Lord Lieutenant of Ireland). I. J. Sanders

Lords, House of. See **House of Lords.**

Lord's Prayer is the most widely said Christian prayer. By tradition, it is one of the three basic statements of Christian faith. The other two are the Apostles' Creed and the Ten Commandments. The Lord's Prayer is found in the Christian Bible and is said to have been taught by Jesus Himself. It is also known as the *Pater Noster,* from the first two words of the prayer, which in Latin mean *Our Father.*

The Lord's Prayer appears in two forms in the New Testament—in Matthew 6:9-13 and in Luke 11:2-4. In general, all Christian groups use the longer version found in Matthew. The prayer begins by praising God and asking for God's name to be glorified. It requests that God's kingdom may come and God's will be done. The prayer then asks for the provision of food, for forgiveness, and for protection against evil. Some versions of the prayer in Matthew also conclude by praising God.

The Lord's Prayer is used by members of all Christian denominations in both public and private worship. It is also sometimes said by nonreligious groups, such as athletic teams before or after games and organizations at meetings. Many composers have set the prayer to music. The American composer Albert H. Malotte wrote one of the best-known versions in 1935.

Joseph M. Hallman and Mark Juergensmeyer

Lord's Supper. See **Communion.**

Lorelei, *LAWR uh ly,* is a high cliff that towers about 430 feet (131 meters) above the Rhine River between Mainz and Koblenz in southwestern Germany. At that point, the river is swift and dangerous. Legend says the echo heard at the Lorelei is the voice of a beautiful but wicked *siren* (river nymph) luring boatmen to destruction. The siren is also called Lorelei. The German writer Clemens Brentano may have invented the legend in his ballad "Die Lore Lay" (1801). See also **Rhine River.**

John W. Boyer

Lorentz, *LOHR ehnts,* **Hendrik Antoon,** *HEHN drihk AHN tohn* (1853-1928), was a Dutch physicist. He became famous for his electron theory of matter, and shared the 1902 Nobel Prize in physics with Dutch physicist Pieter Zeeman for explaining the effects of magnetism on light. See **Zeeman effect.**

Lorentz assumed that matter and the *ether* interact only by means of electrically charged particles. The ether was a medium that Lorentz and other scientists of his day had reason to believe occupied all space. Lorentz's electron theory suggested that moving bodies are shortened in their direction of motion through the ether. This shortening occurs because motion affects forces between the charged particles that make up matter. The change in length actually occurs. It is too small to notice, however, except in precise experiments carried on at very high speeds. The equations that show how motion deforms bodies are called the *Lorentz transformations.* See **Relativity.**

Lorentz was born on July 18, 1853, in Arnhem, the Netherlands. He graduated from, and taught at, Leiden University. He died on Feb. 4, 1928. Bruce R. Wheaton

Lorenz, *LOH rehnts,* **Konrad Zacharias,** *KOHN raht TSAH kah REE ahs* (1903-1989), an Austrian naturalist, was one of the founders of *ethology,* the study of animal behavior. Lorenz and two other ethologists—Karl von

The Lord's Prayer

The words of the Lord's Prayer vary among the many translations of the New Testament. Four familiar versions from Matthew are:

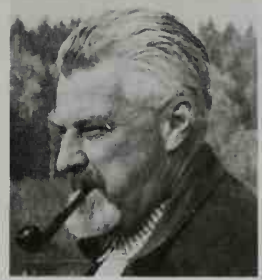
The King James version (Protestant):
Our Father which art in heaven, Hallowed be thy name. Thy kingdom come. Thy will be done in earth, as it is in heaven. Give us this day our daily bread. And forgive us our debts, as we forgive our debtors. And lead us not into temptation, but deliver us from evil: For thine is the kingdom, and the power, and the glory, for ever. Amen.

The New Revised Standard version (Protestant):
Our Father in heaven, hallowed be your name. Your kingdom come. Your will be done, on earth as it is in heaven. Give us this day our daily bread. And forgive us our debts, as we also have forgiven our debtors. And do not bring us to the time of trial, but rescue us from the evil one.

The Baltimore Catechism version (Roman Catholic):
Our Father who art in heaven, hallowed be Thy name; Thy kingdom come; Thy will be done on earth as it is in heaven. Give us this day our daily bread; and forgive us our trespasses, as we forgive those who trespass against us; and lead us not into temptation, but deliver us from evil. Amen.

The New American Bible version (Roman Catholic):
Our Father in heaven, hallowed be your name, your kingdom come, your will be done, on earth as in heaven. Give us today our daily bread; and forgive us our debts, as we forgive our debtors; and do not subject us to the final test, but deliver us from the evil one.

Frisch of Austria and Nikolaas Tinbergen, born in the Netherlands—received the 1973 Nobel Prize for physiology or medicine for their work on animal behavior.


UPI/Bettmann
Konrad Lorenz

Unlike psychologists, who had studied animal behavior in laboratories, Lorenz studied animals in their natural environments. He observed that instinct plays a major role in animal behavior—a view that conflicted with the ideas of many psychologists. He described the instinctive process of *imprinting,* by which, for example, an animal may learn to identify its owner as its parent (see **Instinct** [Instinct and learning]).

Lorenz was born in Vienna. He earned an M.D. degree in 1928 and a Ph.D. degree in 1933, both at the University of Vienna. In 1954, Lorenz became codirector of the Max Planck Institute for Physiology of Behavior in Germany. He became director of the Institute of Comparative Ethology of the Austrian Academy of Sciences in 1973.

Lorenz wrote several books on animals and their behavior. They include *King Solomon's Ring* (1952) and *On Aggression* (1966). John A. Wiens

See also **Ethology**.

Lorenzini, Carlo. See **Collodi, Carlo**.

Lorenzo the Magnificent. See **Medici, Lorenzo de'**.

Loris, *LAWR ihs,* is a slow-moving animal that lives in trees. Lorises are *primates,* members of the order of animals that includes monkeys, apes, and human beings. The *slender loris* lives in India and Sri Lanka. The larger *slow loris* is found from India to Indonesia.


© Tom McHugh, Photo Researchers

The slow loris, *above,* is found from India to Indonesia. Lorises live in trees and are active at night. These small, tailless animals use their hands and feet to grasp branches while climbing.

Most lorises are gray or brown and grow 8 to 10 inches (20 to 25 centimeters) long. Their three-cornered faces and large eyes help frighten away predators. They either have no tail or a short, stumpy one concealed in the fur.

The loris lives alone most of the time. The animal sleeps in the daytime with its feet clasped around the limb of a tree, and its body rolled into a ball with the head tucked between the thighs. During the night, the loris prowls around in search of food. The loris lives on fruit, insects, young birds, and bird eggs.

Scientific classification. Lorises belong to the loris family, Lorisidae. The scientific name for the slender loris is *Loris tardigradus.* The slow loris is *Nycticebus coucang.* Clyde Jones

Lorne, *lawrn,* **Marquess of,** *MAHR kwihs* (1845-1914), served as governor general of Canada from 1878 to 1883. In 1880, he helped establish an office in London called the office of high commissioner of Canada to improve communications between the Canadian and British governments. In 1882, he founded the Royal Society of Canada, which promotes the arts and sciences. Lorne also helped found the Royal Canadian Academy of Arts and the National Gallery of Canada.

Lorne was born in London. His given and family name was John Douglas Sutherland Campbell. In 1871, he married Princess Louise Caroline Alberta, a daughter of Queen Victoria.

Lorne was elected to the British Parliament in 1868. He served in the House of Commons as a member of the Liberal Party until 1878. He also served in the House of Commons as a Unionist from 1895 to 1900. Lorne became the ninth Duke of Argyll in 1900. Jacques Monet

Lorrain, Claude. See **Claude**.

Lorraine. See **Alsace-Lorraine**.

Lorry. See **Truck**.

Los Alamos National Laboratory, in Los Alamos, N. Mex., is a leading research institution in the United States. It is involved in the application of science and technology to problems of U.S. national security. Activities at the laboratory include the development of nuclear warheads, the production and testing of nuclear materials, and the creation of designs for new weapons. The laboratory is also responsible for developing technology for use in verifying that other nations fulfill their arms control commitments. Other research focuses on such areas as nuclear physics and the disposal of nuclear waste.

The University of California operates Los Alamos National Laboratory for the United States Department of Energy. The Los Alamos National Laboratory was established in 1943 as part of the World War II Manhattan Project to build the first nuclear weapons (see **Manhattan Project**).

Thousands of scientists, engineers, and other professionals work at the laboratory. It contains some of the largest and fastest computers in the world. Its Clinton P. Anderson Meson Physics Facility (LAMPF) houses a proton linear accelerator that is $\frac{1}{2}$ mile (0.8 kilometer) long. Many scientists consider LAMPF to be one of the world's leading nuclear science facilities.

Toni Grayson Joseph



C. Moore, West Light

Downtown Los Angeles is laced with high-speed freeways. The people of Los Angeles depend heavily on the freeways to travel about their sprawling city. Los Angeles is the largest manufacturing center in the United States as well as a business and financial hub.

Los Angeles

Los Angeles is a huge city in southern California. It ranks as the second largest city in the United States, after New York City. Few U.S. cities have grown as rapidly as Los Angeles. In 1850, when Los Angeles became a city, it had only 1,610 people. In 1940, with a population of about 1 $\frac{1}{2}$ million, it ranked as the nation's fifth largest city. In 2000, it had more than 3 $\frac{2}{3}$ million people.

Los Angeles is the seat of Los Angeles County, which is the nation's largest county in population. The county had about 9 $\frac{1}{2}$ million people in 2000, and it includes dozens of communities in addition to Los Angeles. Los Angeles County makes up the city's metropolitan area. Los Angeles and other communities in the area run together and look much alike, making it hard to tell where one ends and another begins. For this reason, the area has been described as "a hundred suburbs in search of a city."

More than half the people of Los Angeles County moved there from other parts of the United States or from other countries. Many immigrants moved to Los Angeles seeking good jobs or to escape from political conflicts in their countries. Some people were attracted by the city's scenic location, pleasant climate, and outdoor way of life. Golden beaches line the Pacific Ocean to the west and south, and tall, snow-capped mountains rise to the northeast. The ocean and the mountains help give Los Angeles a mild climate the year around.

Each year, millions of tourists visit the Los Angeles area. They come to enjoy the area's beaches, ski resorts, and other recreational facilities, as well as its many cultural and entertainment attractions.

Los Angeles is the industrial, financial, and trade center of the western United States. It is also the largest manufacturing center in the country. It is among the nation's leaders in the production of aircraft and equipment for space exploration. The city's film and television industry is world famous. Banks and other financial institutions in Los Angeles rank among the largest in the country and have helped finance the area's rapid growth. The Port of Los Angeles is one of the busiest on the West Coast. Each year, thousands of cargo ships, fishing boats, and pleasure craft dock at this port.

Despite all its glories, Los Angeles has serious problems. Earthquakes have caused severe damage. Riots, triggered by racial conflict, have sometimes broken out. Many other problems have resulted from the rapid increase in population. The city has little open land left, and housing—especially low-cost housing—is in short



Tony Freeman, Photo Edit

Hollywood Boulevard in Los Angeles has the names of motion-picture and television celebrities on large stars set in the sidewalks. The city's film and TV industry is world famous.

Facts in brief

Population: *City*—3,694,820. *Metropolitan area*—9,519,338. *Consolidated metropolitan area*—16,373,645.
Area: *City*—466 mi² (1,207 km²). *Metropolitan area*—4,113 mi² (10,653 km²). *Consolidated metropolitan area*—34,008 mi² (88,080 km²).
Altitude: 275 ft (84 m) above sea level.
Climate: *Average temperature*—January, 55 °F (13 °C); July, 73 °F (23 °C). *Average annual precipitation* (rainfall, melted snow, and other forms of moisture)—15 in (38 cm). For the monthly weather in Los Angeles, see **California** (Climate).
Government: Mayor-council. *Terms*—4 years for the mayor and the 15 council members.
Founded: 1781. Incorporated as a city in 1850.

Largest communities in the Los Angeles area

Name	Population	Name	Population
Los Angeles	3,694,820	Torrance	137,946
Long Beach	461,522	Pasadena	133,936
Glendale	194,973	East Los Angeles*	124,283
Santa Clarita	151,088	Lancaster	118,718
Pomona	149,473	Palmdale	116,670

*Unincorporated.

Source: 2000 census.





Symbols of Los Angeles. The city's flag was adopted in 1931, the 150th anniversary of the founding of Los Angeles. The city seal symbolizes Los Angeles's history under the governments of Spain, Mexico, the California Republic, and the United States.

supply. The people depend mainly on automobiles for transportation, and they own more than 5 million cars. The freeways are often jammed, and exhaust fumes and smoke from factories have created serious air pollution. In 1989, California adopted a long-term plan to combat air pollution in the city and surrounding area. To help reduce pollution and traffic jams, Los Angeles has improved its public transportation system.

The city

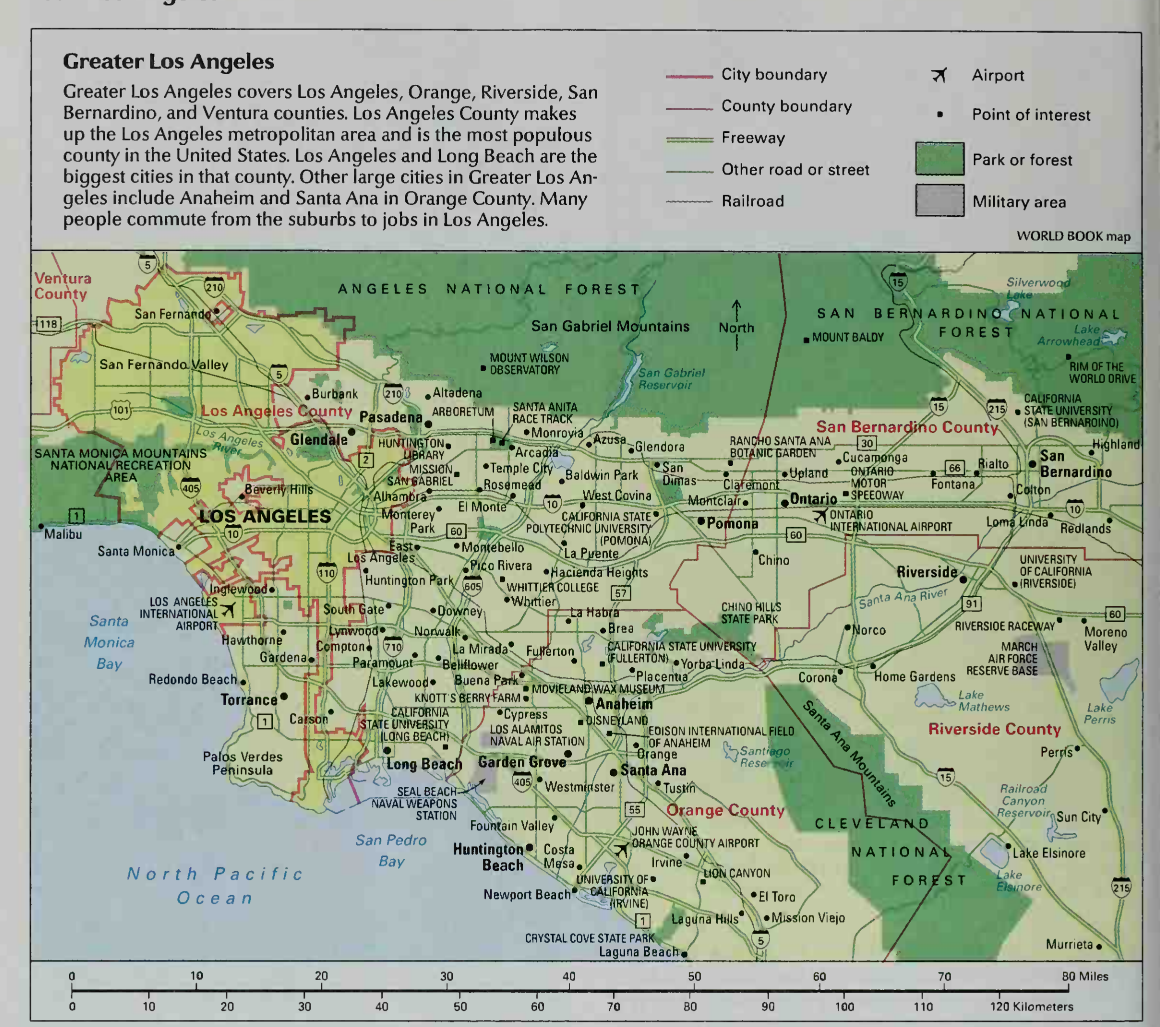
Los Angeles lies on the Pacific coast in southern California. It is about 350 miles (563 kilometers) southeast of San Francisco and about 130 miles (209 kilometers) northwest of San Diego and the Mexican border. Los Angeles covers 466 square miles (1,207 square kilometers), making it one of the nation's largest cities in area. It stretches about 50 miles (80 kilometers) from the San Fernando Valley in the north to Los Angeles Harbor at San Pedro Bay in the south. From east to west, the city extends about 30 miles (48 kilometers)—from the San Gabriel Mountains to the Pacific Ocean.

In the past, Los Angeles added to its area by annexing such nearby cities and towns as Hollywood, San Pedro, Van Nuys, and Westwood. These places are now districts of Los Angeles. Los Angeles County includes 87 incorporated cities besides the city of Los Angeles. These communities include the cities of Burbank, Long Beach, Pasadena, and Santa Monica. Beverly Hills, San Fer-



WORLD BOOK map

Los Angeles lies on the Pacific coast in California.



nando, and West Hollywood are independent communities surrounded by Los Angeles.

Los Angeles can be divided into eight main sections: (1) Downtown Los Angeles, (2) South-Central Los Angeles, (3) Central Los Angeles, (4) the San Fernando Valley, (5) West Los Angeles, (6) South Bay, (7) the Port of Los Angeles, and (8) East Los Angeles. These sections do not have definite boundaries. They are chiefly areas that have similar types of housing, people with similar backgrounds, or some other common features.

Downtown Los Angeles, the main business and shopping center, lies near the eastern edge of the city. Los Angeles residents do not depend on their downtown section so much as do the people of other cities. Los Angeles has many commercial and shopping districts because it spreads over a large area.

Los Angeles's downtown area has changed greatly since 1957. That year, the city government repealed a law that prevented the construction of buildings higher than 150 feet (46 meters), or about 13 stories. The law was originally passed because of the threat of earthquakes. But by 1957, new engineering and construction methods made it possible to construct taller buildings designed to withstand earthquakes. Today, numerous 40- and 50-story buildings rise in the downtown area. The city's tallest building—Library Tower—rises 73 stories, or 1,018 feet (310 meters), downtown.

City Hall, one of the best-known landmarks in Los Angeles, stands in the downtown area. For many years, this 26-story, 454-foot (138-meter) structure, with its distinctive white tower, was the city's tallest building and the only exception to the 150-foot (46-meter) height limit. City Hall is part of a group of city, county, state, and federal buildings that make up the Civic Center.

At the west end of the Civic Center stands the Performing Arts Center of Los Angeles County. It consists of two theaters and a concert hall. A group of luxury apartment houses called Bunker Hill Towers and several tall office buildings form an impressive skyline in this area. Nearby is California Plaza, a development which includes two office buildings, the Museum of Contemporary Art, and the Watercourt, a performing arts plaza.

The downtown area also includes some of Los Angeles's oldest buildings. Northeast of the Civic Center lies an area called the *Pueblo de Los Ángeles* (Town of the Angels). A group of settlers from Mexico founded Los



Los Angeles

This map shows the city of Los Angeles and its major points of interest. Many areas of Los Angeles were once separate towns that the city annexed over the years.

Angeles there more than 200 years ago. The area has been restored to resemble a village of old Mexico. The Pueblo includes the Old Plaza, a charming public square shaded by 100-year-old magnolia trees. Buildings dating back to the late 1800's surround the Plaza. Olvera Street, one of Los Angeles's oldest streets, begins at the Plaza and runs north. Colorful stalls selling Mexican handicrafts line the street. Adobe buildings from the early 1800's house Mexican craft shops and restaurants.

Three blocks southwest of City Hall lies a Hispanic American shopping district with many restaurants and shops owned by immigrants from Mexico and Central America. There, the sound of modern Mexican music pours from cafes and record, tape, and disc shops. Newsstands sell Mexican magazines and newspapers, and Spanish is heard more often than English. Little Tokyo, a Japanese neighborhood, is two blocks southeast of City Hall. This area has many Japanese restaurants, shops that sell goods imported from Japan, art galleries, and food markets. A few blocks north of City Hall lies Chinatown. There, many Chinese American residents operate restaurants and shops that sell antiques, art objects, and souvenirs. Many Korean Americans live in a section called Koreatown southwest of downtown.

South-Central Los Angeles covers a huge region south of the downtown area. It was long one of the largest black communities in the United States but is now racially mixed. During World War II (1939-1945), many African Americans moved to South-Central Los Angeles to work in war plants. After the war, the city's black population continued to increase. The African American community spread south to include a district called Watts, about 10 miles (16 kilometers) from downtown. Watts has become the center of the African American community in Los Angeles. The black population has also spread about 10 miles (16 kilometers) west through the independent community of Inglewood. Some black neighborhoods of South-Central Los Angeles consist of slum housing. But others have expensive homes. Also, thousands of African Americans have moved to the suburbs. Hispanic Americans and people of Asian ancestry now make up more than half the population of South-Central Los Angeles.



Michael Newman, Photo Edit

South-Central Los Angeles, south of downtown, has some neighborhoods with run-down housing such as these relatively inexpensive bungalows. Other South-Central neighborhoods have costly homes.



Tony Freeman, Photo Edit

Rodeo Drive is a street in Beverly Hills famous for its fine restaurants, luxury hotels, and expensive shops. Beverly Hills is the home of many movie stars and other wealthy people.

Central Los Angeles lies between the downtown area, on the east, and the independent community of Beverly Hills, on the west. Parts of this area contain a growing number of Asians and other immigrants. A large part of Central Los Angeles consists of Hollywood, a community famous for TV and motion-picture studios. Hollywood Boulevard, one of Los Angeles's best-known streets, runs through Hollywood's business district. The names of Hollywood celebrities are engraved on big stars set in the sidewalks along the boulevard and its side streets.

Sunset Boulevard, another famous Los Angeles street, is just south of Hollywood Boulevard. It begins in the downtown area and winds almost 25 miles (40 kilometers) through Central Los Angeles to the Pacific Ocean. The section that runs through the city of West Hollywood is called *Sunset Strip* or the *Strip.* It is lined with smart shops and expensive restaurants and cafes. It is also known for its nightclubs and coffee houses.

Wilshire Boulevard, about $2\frac{1}{2}$ miles (4 kilometers) south of Sunset Boulevard, also runs from downtown through Central Los Angeles to the ocean. Wilshire Boulevard is known for its tall office buildings and fine shops and department stores. A section of the street called the *Wilshire Center* is lined with handsome modern buildings.

The San Fernando Valley lies northwest of Hollywood across the Santa Monica Mountains. The Los Angeles section of the valley covers 234 square miles (606 square kilometers), which the city annexed in 1915. When Los Angeles annexed the section, it consisted of large open areas and several rural communities. Today, huge housing developments and shopping centers cover the San Fernando Valley. Over 1 million people, about a third of Los Angeles's residents, live in the valley. Most of them live in single-family houses with patios and barbecues in the backyard. Many homes include a backyard swimming pool. The area also has numerous small apartment buildings and high-rise buildings. The independent communities of Burbank and San Fernando also are in the valley. Another valley community, Northridge, was the center of a major earthquake in 1994.

West Los Angeles occupies the area from Beverly Hills to the city's western border. The Santa Monica Mountains cover much of West Los Angeles.

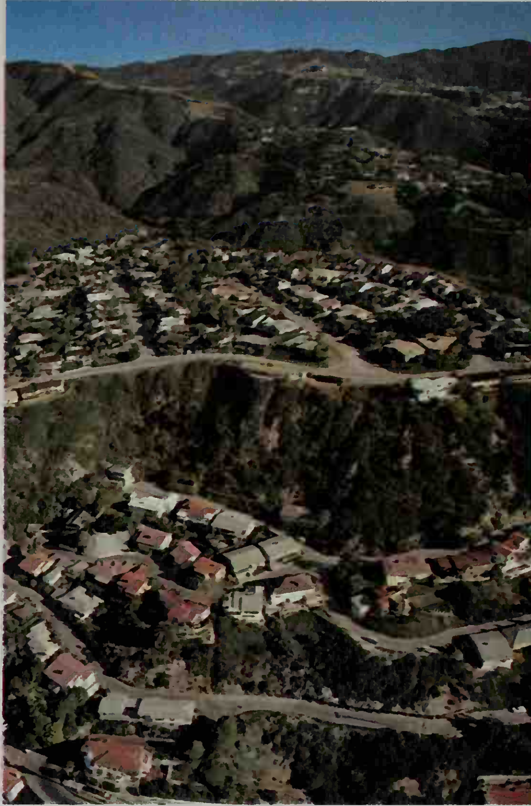
Century City, a planned community, borders Beverly Hills on the southwest. This "city within a city" includes office and residential buildings, large hotels, a shopping center, restaurants, and theaters. Century City stands on land that was once part of the Twentieth Century Fox motion-picture studio.

The community of Westwood and the University of California at Los Angeles (UCLA) lie west of Century City. Westwood began in the 1920's as a small village of Spanish-style buildings. It has grown with the UCLA campus and has become a lively college town, shopping area, and entertainment center.

Three of the city's most fashionable communities—Bel Air, Brentwood, and Pacific Palisades—are in West Los Angeles at the foot of the Santa Monica Mountains. Bel Air is north of Westwood, and Brentwood and Pacific Palisades are west of it.

The community of Venice lies between the city of Santa Monica and Marina del Rey, a harbor for small boats. Venice was designed in the early 1900's as a city of canals like Venice, Italy. Today, most of the canals have been filled in, and the area consists of aging beach homes and hotels, and a few modern apartment buildings.

South Bay lies along the Pacific Ocean from Marina del Rey south to the Palos Verdes Peninsula. It includes an area of the city of Los Angeles called Playa del Rey, as well as several independent communities. Playa del Rey, south of Marina del Rey, was once a pleasant beach community. Today, it is troubled by noise from Los Angeles International Airport.



George Hall, Woodfin Camp Inc.

Hollywood Hills is a residential section of Hollywood, one of Los Angeles's most glamorous districts. Homes in Hollywood Hills extend far up the slopes of the Santa Monica Mountains.



J. R. Eyerman

The San Fernando Valley lies northwest of Central Los Angeles across the Santa Monica Mountains. Huge housing developments and shopping centers cover the valley. Many of the homes have an outdoor swimming pool.

The independent communities of El Segundo, Manhattan Beach, Hermosa Beach, and Redondo Beach stretch south along the ocean from Playa del Rey to the Palos Verdes Peninsula. Cities on the peninsula include Palos Verdes Estates and Rolling Hills Estates.

The Port of Los Angeles is on San Pedro Bay, about 20 miles (32 kilometers) south of the downtown area. It includes the communities of San Pedro and Wilmington. The port area is almost surrounded by independent cities and is connected to South-Central Los Angeles by a narrow strip of land annexed by the city in the early 1900's. The Port of Los Angeles has one of the world's largest artificial harbors. It covers about 7,000 acres (2,800 hectares). A breakwater, built between 1899 and 1914, protects both the Los Angeles Harbor and the Long Beach Harbor to the east. The breakwater is 9 miles (14 kilometers) long.

East Los Angeles lies east of the downtown section. Since the 1920's, many poor, unskilled immigrants arriving in Los Angeles have settled in this area. East Los Angeles once had a large Jewish population. Since the 1940's, however, it has been made up almost entirely of

Mexican Americans and other Hispanic Americans, and Asian Americans.

The people who live in East Los Angeles call the area the *barrio,* a Spanish word for *neighborhood.* Many of the people—especially younger Mexican Americans—call themselves *Chicanos. Chicano* is a short form of *Mexicano,* the Spanish word for Mexican. Other Hispanic people prefer the name *Latinos,* which means *Latin Americans.* The barrio extends far beyond the Los Angeles city limits into parts of Los Angeles County that do not belong to any city. The entire area has more than 4 million Hispanic Americans, including about 3 million Mexican Americans. Many of these people speak little English. Many of the houses in the barrio are run-down wood-frame cottages built in the 1920's.

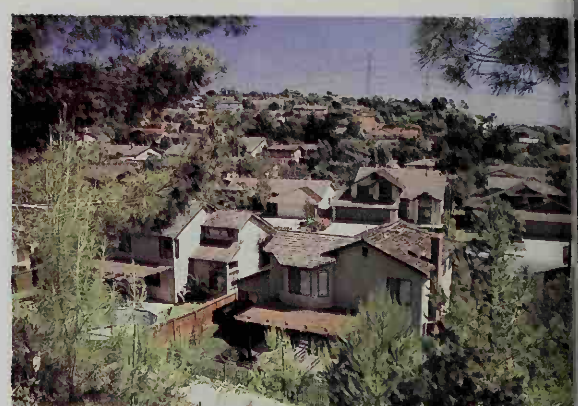
Metropolitan area. The Los Angeles metropolitan area, as defined by the federal government, covers all of Los Angeles County. The area is officially known as the *Los Angeles-Long Beach Metropolitan Statistical Area.* By 2000, it had about 9 $\frac{1}{2}$ million people and ranked as the nation's largest single metropolitan area. The New York-Northern New Jersey-Long Island Consolidated Metropolitan Area is the largest combined metropolitan area in the country, with about 21 million people. The Los Angeles-Riverside-Orange County Consolidated Metropolitan Area consists of four metropolitan areas. They are Los Angeles-Long Beach, Orange County, Riverside-San Bernardino, and Ventura. Together they have about 16 $\frac{1}{3}$ million people.

The Los Angeles-Riverside-Orange County Consolidated Metropolitan Area is also known as *Greater Los Angeles.* Greater Los Angeles takes in Orange, Riverside, San Bernardino, and Ventura counties as well as Los Angeles County. Many of the people who live in these surrounding counties work in Los Angeles.

The communities in the Los Angeles metropolitan area blend together so that, in many cases, it is difficult to tell one from another. As a result, the entire metropolitan area is often referred to as simply Los Angeles. Many of the famous features and tourist attractions that people from other parts of the country think are in Los Angeles are actually outside the city.

Major suburbs north and east of Los Angeles include Burbank, Glendale, and Pasadena. The Walt Disney and Warner Brothers studios are in Burbank, and the National Broadcasting Company (NBC) has its West Coast headquarters there. Glendale includes famous Forest Lawn Memorial Park, an elaborately landscaped cemetery filled with statues and other works of art. Pasadena is known for its Tournament of Roses, held on or near New Year's Day. The tournament consists of a parade of flower-covered floats, followed by a football game in the Rose Bowl. Each year, the champions of the Big Ten and the Pacific Ten, two of the nation's top college conferences, compete in the Rose Bowl game.

Beverly Hills, which lies west of Hollywood, is almost completely surrounded by Los Angeles. It is a fashionable community of expensive homes, many of which belong to motion-picture and television stars. Santa Monica, an attractive residential and resort city, lies southwest of Beverly Hills along the Pacific Ocean. It is the site of the Rand Corporation, a research organization that studies defense questions. Culver City, east of Santa Monica, has the Sony Pictures Studios.

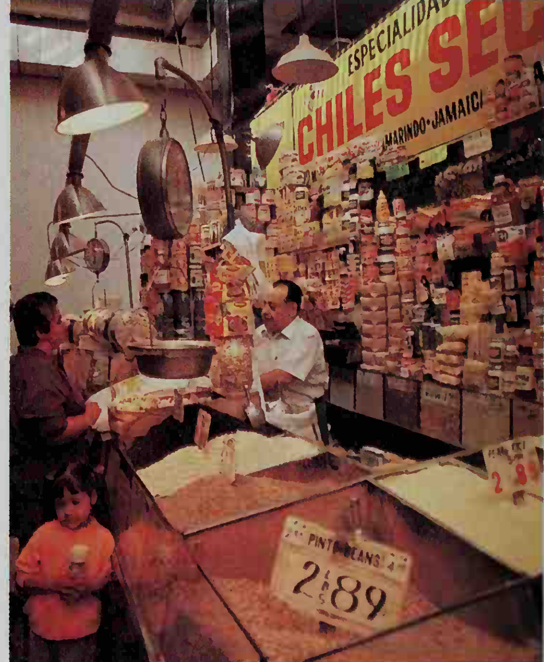


Tony Freeman, Photo Edit

Suburban Orange County has many middle-class residential communities. Much of the county's housing consists of comfortable single-family homes with backyard patios.

The residential towns of Gardena and Torrance lie west of the strip of Los Angeles that connects the Port of Los Angeles with South-Central Los Angeles. The Palos Verdes Peninsula juts into the Pacific Ocean south of Torrance. The city of Long Beach is east of the Port of Los Angeles. Long Beach is also an important port city.

Many residential communities in Orange County lie in the Greater Los Angeles area. They include Anaheim, Buena Park, Garden Grove, and Santa Ana. Some of them have well-known tourist attractions. For example, Anaheim is the site of Disneyland, a world-famous



Robert Holmes

Mexican American stores in East Los Angeles cater to the area's thousands of people of Mexican ancestry. More Mexican Americans live in Los Angeles than in any other U.S. city. Many moved to Los Angeles from Mexico in search of a better life.

amusement park. Knott's Berry Farm, which has a ghost town and an Indian village, is in Buena Park.

People

Through the years, large numbers of people from other parts of the United States and the world have settled in Los Angeles. People of Hispanic, black, or Asian ancestry make up about two-thirds of the city's population. Most of the rest of the people are of European ancestry. They include people of English, German, Irish, Italian, and Russian descent. Roman Catholics make up the city's largest religious group. Other large religious groups include Christian Scientists, Episcopalians, Jews, Lutherans, Methodists, and Muslims.

Ethnic groups. Hispanic Americans account for about 47 percent of Los Angeles's population. People of Mexican ancestry make up the largest Hispanic group by far. Los Angeles has about 1 $\frac{1}{4}$ million Mexican Americans, more than any other U.S. city. Most were born in the United States. But many moved to the city from Mexico in search of higher-paying jobs and a better life. The city's Hispanic population also includes people from—and descendants of people from—Cuba, Puerto Rico, and the countries of Central America and South America. Most of the city's Mexican Americans and other Hispanics live in crowded, run-down barrios in East and South Los Angeles. But there are also barrios in other sections of the city. Discrimination, a lack of education, and the inability to speak English prevent many Hispanics from finding well-paying jobs and leaving the barrios.

Blacks make up 11 percent of the population of Los Angeles. The city has about 415,000 blacks. Most live in South-Central Los Angeles. Many have been prevented from leaving this area by poverty, a lack of education, and discrimination in jobs and housing. But many other African Americans live in integrated parts of the city and its suburbs. In fact, more blacks live in suburban areas of Los Angeles than in those of any other U.S. city.

People of Asian ancestry make up 10 percent of the city's population, or about 370,000 people. The largest Asian groups, in order of size, are Filipinos, Japanese, Chinese, and Koreans. Asians live in various parts of the city, and they have better opportunities for higher education and good jobs than Hispanics and blacks do. However, Asians once had much the same problems of poverty and discrimination that Hispanics and blacks now face.

Housing. Before the 1960's, most of the housing in Los Angeles consisted of single-family bungalows, cottages, and ranch-style homes. Land in the area had been plentiful and inexpensive. Developers could buy large sections of land, build hundreds of houses at one time, and sell the homes at low prices. The construction of single-family housing developments reached its peak in the 1940's and 1950's. In such areas as the San Fernando Valley, thousands of homes were built on land once covered by orange groves and farms.

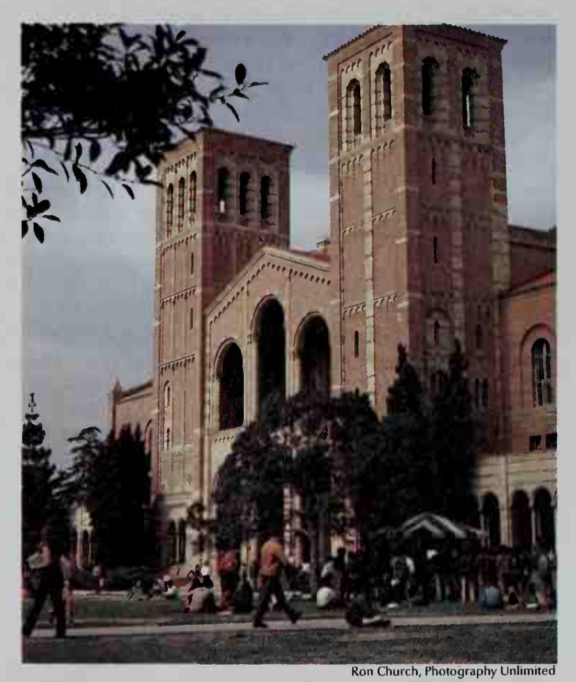
By the 1960's, Los Angeles had little vacant land left—and that land was expensive. In addition, the cost of labor and materials had increased greatly. As a result, the majority of new single-family homes were more expensive than most families could afford. Builders then began to construct more apartment houses.

In 1962, for the first time in the city's history, more apartments were built than single-family houses. Since 1962, builders have continued to construct more apartments than houses. Many of these buildings have swimming pools, health clubs, and other luxury features.

Education. Los Angeles has the second largest public school system in the United States. Only New York City's system is larger. The Los Angeles Unified School District, as the public school system is officially called, extends beyond the city limits. It covers 710 square miles (1,840 square kilometers), an area about one and a half times as large as the city itself. The district includes more than 900 schools with about 795,000 students. Over 60,000 students attend about 225 private and church-supported schools in Los Angeles.

The Board of Education runs Los Angeles's public school system. The board consists of seven members elected by the voters to four-year terms. The board members appoint a superintendent to serve as chief administrator of the school system.

In the late 1960's, the Los Angeles school system began to have serious financial problems as enrollments and operating costs increased faster than the system's income. To save money, class sizes were increased, some teachers discharged, and class hours shortened. In 1970, about half the district's schoolteachers staged a month-long strike for higher wages and improved classroom conditions. The teachers accepted a pay raise, though many of them felt the money should be used for classroom improvements. In 1989, more than half the district's teachers staged a strike that lasted two weeks. Again, the teachers accepted a pay raise.



Ron Church, Photography Unlimited

Institutions of higher education in Los Angeles rank among the finest in the United States. Royce Hall, *above,* is the liberal arts building at the University of California at Los Angeles (UCLA), a campus of the University of California.

Before 1978, about 70 percent of the school system's funds came from taxes on real estate and personal property of district residents. In 1978, voters passed an amendment to the state Constitution cutting property taxes. As a result, the city's school system now depends on state aid for about 80 percent of its expenses. About 20 percent of the budget still comes from local real estate and personal property taxes.

Los Angeles has many institutions of higher education. The Los Angeles Community College District administers nine community colleges in and near the city. The colleges offer two-year programs in a variety of subjects. These colleges, formerly called junior colleges, also offer courses that can later be used for credit in senior colleges.

The city's public universities include the University of California at Los Angeles (UCLA), a branch of the University of California. Los Angeles also is the home of California State University at Los Angeles and California State University at Northridge.

The University of Southern California (USC) is a major private university in Los Angeles. There are many other private universities and colleges in the area. They include Alliant University, DeVry Institute of Technology, Loyola Marymount University, Mount St. Mary's College, Occidental College, Pepperdine University, and Woodbury University.

Social problems. The chief social problems in Los Angeles, as in most other large U.S. cities, include poverty, and racial and ethnic conflicts. Los Angeles has one of the highest standards of living of any city in the nation. Yet thousands of Los Angeles's residents do not share in the wealth. Most of these people are African Americans who live in the ghettos of South-Central Los Angeles and Mexican and other Hispanic Americans who live in the barrios of East Los Angeles and other parts of the city. The city's poor also include thousands of homeless people, many of whom live downtown.

The people of the ghettos and barrios live in rundown, overcrowded homes and have little education. Many have difficulty finding work, and others have low-paying jobs. A large number of students quit school. Crime is widespread, and many young people belong to gangs that engage in criminal activity. In the barrios, many people speak only Spanish. This limits their opportunities for jobs and education.

Conditions in the ghettos and barrios of Los Angeles have led to serious riots. In 1965, blacks in the Watts district of South-Central Los Angeles rioted for five days. The rioting resulted in 34 deaths and about $40 million in property damage. In 1992, a more widespread riot in South-Central and other parts of Los Angeles caused 53 deaths and more than $1 billion in damage.

In the 1980's, there was a large increase in the amount of crime committed by members of gangs in Los Angeles. Much of the crime, which has continued, has been related to the buying and selling of illegal drugs. Many people have been killed in the violence.

The local, state, and federal governments have taken action to help blacks and Hispanics in Los Angeles. Job-training courses have been set up to teach unskilled workers. Spanish-speaking teachers have been assigned to barrio schools, and black and Hispanic studies have been introduced in ghetto and barrio schools. Thousands of students have been bused out of these crowded schools into suburban schools. Legal aid programs have been set up to help minority group members who feel they have been discriminated against in seeking a job or a place to live. But progress has been slow, partly because poor, unskilled people—including many illegal immigrants—have continued to pour into the overcrowded ghettos and barrios.

Economy

Los Angeles ranks as the most important center of industry, trade, and finance in the western United States. The city's economy, like its population, has grown rapidly since World War II. Since the end of the war in 1945, the number of jobs in the Los Angeles area has increased greatly. During this period, a large number of new industries, financial institutions, and trading facilities moved into the area and existing ones expanded.

Industry. Los Angeles is the largest U.S. manufacturing center. The Los Angeles area has almost 25,000 factories. Traditionally, aerospace has been one of the area's chief industries. This industry involves the manufacture of aircraft, spacecraft, and related parts and equipment. The aerospace industry attracted more engineers, mathematicians, scientists, and skilled technicians to Los Angeles than to any other U.S. city. But in the 1990's, the aerospace industry suffered a major downturn, resulting in numerous factory closings and the loss of thousands of jobs.

Los Angeles—especially the Hollywood district—has long been known as the motion-picture capital of the world. Filmmaking reached its peak in the Los Angeles area in the mid-1940's. By the late 1940's, television had begun to attract more and more moviegoers. The studios reduced the number of motion pictures they made and dismissed many employees. In time, the studios became increasingly involved in making films for television. Also, separate network television facilities were built in the Los Angeles area. Today, most TV films are made in Los Angeles and many other TV comedies, dramas, and other shows originate there.

Los Angeles has rich deposits of petroleum, which is pumped from wells scattered throughout the area. The city's petroleum industry dates back to the late 1800's, when the first wells were drilled. In addition to producing petroleum, the city ranks as one of the nation's top oil-refining centers. It is also a major manufacturer of oil-field equipment.

Other important industries in Los Angeles produce a wide range of products. The city is a leading producer of clothing, computers, furniture, rubber, and tires. Other products include chemicals, electric equipment, glassware and pottery, iron and steel, toys, and travel trailers. The construction industry and printing and publishing are also important. The area is also a major center of the music-recording industry and has more than 50 record companies.

The Port of Los Angeles is one of the nation's chief fishing ports and one of the largest fish-canning centers in the world. Every day, hundreds of boats bring in huge catches of halibut, sea bass, tuna, and other fishes.

Trade. The Port of Los Angeles handles a greater annual value of cargo than any other United States port. This cargo includes foreign imports and exports, as well



The Port of Los Angeles, on San Pedro Bay, handles more foreign and domestic ships than any other West Coast port. It is also one of the nation's leading fishing ports. In addition to berths for cargo and passenger ships and for fishing boats, the huge port has facilities for pleasure craft.

J. R. Eyerman, Black Star

as goods going to or coming from other United States ports. Most of the trade between the United States and Japan flows through the Port of Los Angeles. The Port of Los Angeles also handles much of the nation's trade with Australia, Canada, Mexico, South America, and Southeast Asia. Large amounts of domestic and international cargo are also handled at Los Angeles International Airport.

Los Angeles ranks second only to New York City in retail trade. Some of the largest retail chain stores in the United States have their headquarters in Los Angeles. The city also is the West Coast's chief wholesale distribution center.

Finance. Los Angeles is the leading financial center on the West Coast. Ten major savings and loan associations and three major banks have their headquarters in the city. About 70 insurance companies also have their headquarters in Los Angeles.

Tourism. Millions of tourists come to southern California every year. Most of them visit the Los Angeles area and contribute millions of dollars to the city's income. The tourist industry supports hotels, motels, and restaurants, as well as facilities for cultural events and recreational activities.

Transportation. Los Angeles residents depend mainly on automobiles for transportation. The city has one of the world's most extensive *freeway* systems. This 670-mile (1,080-kilometer) network of high-speed expressways runs through Los Angeles, Orange, and Ventura counties. The system consists of overpasses, underpasses, and interchanges. During morning and evening rush hours, slow-moving traffic jams the city's freeway system.

The Metropolitan Transportation Authority, a public corporation, operates a bus and rail system in Los Angeles. Bus routes run throughout Los Angeles County. The rail system carries passengers to destinations in the city and suburbs. The trains travel through subway tunnels in the central parts of Los Angeles and operate at ground level outside the central core. In addition, a separate rail system called Metrolink serves passengers traveling between Los Angeles and surrounding counties.

Two major railroads—the Burlington Northern Santa Fe and the Union Pacific—serve Los Angeles. Passenger trains use the famous Los Angeles Union Station located at the eastern edge of the city's downtown area. This huge railroad terminal was built in the style of California's early Spanish missions, with a tiled roof and two patios.

Los Angeles International Airport, located near Playa del Rey, is one of the world's busiest airports. Both domestic and foreign airlines use Los Angeles International Airport.

Communication. Los Angeles has one general daily newspaper, the *Los Angeles Times.* The *Times* has a daily circulation of more than 1 million copies. Approximately 40 daily community and foreign-language newspapers and more than 100 weekly and semiweekly community papers are also published in the Los Angeles area.

In addition, Los Angeles has a number of *underground* newspapers. These newspapers deal with such matters as civil rights, pollution, and personal and sexual freedom.

Hundreds of magazines, technical publications, and trade journals are published in the Los Angeles area. They include *Los Angeles Magazine,* which features articles of general interest about the area. Many other magazines specialize in single subjects that are popular in the area, such as surfing, hot-rodding, and pottery making.

Ten regular television stations, numerous cable stations, and more than 75 radio stations broadcast in the Los Angeles area. Los Angeles is the corporate headquarters of two television networks—the Fox Broadcasting Network and the United Paramount Network (UPN). In addition, three major networks—ABC, CBS, and NBC—originate many programs from their studios in the area.



Tony Freeman, Photo Edit

The Dorothy Chandler Pavilion is a concert hall at the Music Center: Performing Arts Center of Los Angeles County. The center also features ballet, drama, folk dance, and opera.



George Hall, Woodfin Camp, Inc.

The Los Angeles Zoo in Griffith Park houses animals in natural settings, such as the hippopotamus pool. Moats and fences instead of cages separate the animals from zoo visitors.

Cultural life and recreation

Los Angeles has long been known for its outdoor way of life. The city's climate and its location along the ocean and near snow-covered mountains enable the people to enjoy most outdoor sports the year around. But over the years, the people of Los Angeles have grown increasingly interested in cultural matters. As a result, Los Angeles today ranks not only as one of the nation's top recreational centers but also as a leading cultural center.

The arts. The handsome Music Center: Performing Arts Center of Los Angeles County symbolizes the city's cultural leadership. The center, which was completed in 1967, is part of the Civic Center. It consists of the Dorothy Chandler Pavilion, which is a concert hall; and two theaters, the Ahmanson Theatre and the Mark Taper Forum. The Los Angeles Philharmonic orchestra performs in the Pavilion from October to April. Other attractions at the Music Center: Performing Arts Center include ballet, drama, folk dance, and opera.

Los Angeles has two famous open-air theaters. The Hollywood Bowl, which seats more than 20,000 people, is known for its summer concerts and Easter sunrise services. The Greek Theatre, in Griffith Park northeast of Hollywood, presents musical and dramatic programs. Other theaters and concert halls in Los Angeles include the Century City Playhouse, the Huntington Hartford Theatre, the Ivar Theatre, the Shrine Auditorium, the Shubert Theatre, and many small playhouses. The University of California at Los Angeles and the University of Southern California also present musical and dramatic programs in their campus theaters.

Thousands of actors, artists, musicians, and writers live in Los Angeles. Many have been attracted by the area's movie and TV studios and recording companies. Los Angeles also has long offered creative people an atmosphere that encourages freedom of expression.

Architecture. Many styles of architecture can be seen in Los Angeles. The Spanish style, which features low stuccoed walls and tiled roofs, has long been especially popular in the Los Angeles area. Thousands of small homes—as well as such large buildings as the Union Station and the main branch of the Los Angeles Public Library—have been built in the Spanish style.

Los Angeles has been a center of modern architecture since the 1920's and 1930's. At that time, several of the nation's most imaginative architects, including Richard J. Neutra and Frank Lloyd Wright, designed a number of strikingly modern buildings in the area. Most large buildings constructed in Los Angeles since the 1950's have straight sides and glass walls that have been reinforced to withstand earthquakes.

Libraries. The Los Angeles Public Library, with about 6 million volumes, is among the nation's largest libraries. The library has branches throughout the city and bookmobiles that carry library materials to other areas. Several museums in Los Angeles also have libraries.

Museums. The city's largest art museum is the Los Angeles County Museum of Art in Hancock Park just east of Beverly Hills. Works in its collection range in time from those of ancient Egypt to those of the present. The Museum of Contemporary Art, in downtown Los Angeles, features modern art. There are outstanding art museums in the Los Angeles area outside the city. One of the best known is the Henry E. Huntington Library and Art Gallery in San Marino. It houses some of the world's greatest paintings and a research center on American and English history and literature. The J. Paul Getty Museum, in the Getty Center on the west side of Los Angeles, has a fine collection of paintings and sculptures.

The Natural History Museum of Los Angeles County is in Exposition Park, southwest of the downtown area. The museum's exhibits include a collection of bones of prehistoric animals. Nearby stands the California Science Center, which has displays on the state's agriculture, industry, and resources. In addition, the museum fea-



Robert Holmes

Sandy beaches line the shore of the Pacific Ocean in the Los Angeles area. The city's mild climate and many beaches enable people to swim and surf from spring to fall. Los Angeles residents can enjoy many other outdoor sports the year around.

Tony Freeman, Photo Edit



Farmers Market near Hollywood consists of dozens of stores and stalls that sell fruits, vegetables, flowers, handicrafts, and other goods.

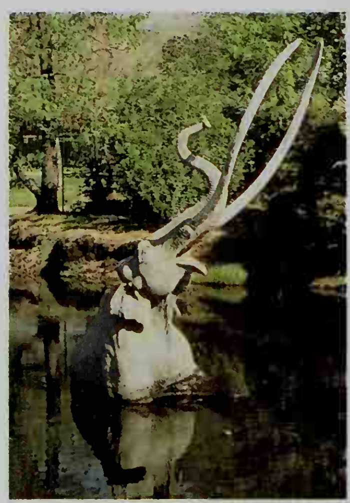
tures an outstanding exhibit on the space age.

Recreation. Los Angeles's location and climate make it possible to go surfing or swimming in the ocean in the morning and skiing at a mountain resort that afternoon. The Los Angeles area has approximately 75 miles (121 kilometers) of beaches along the Pacific. There are ski facilities in the Angeles National Forest, northeast of the city. Golf and boating are also popular all year.

Los Angeles has more than 210 parks, playgrounds, and other recreational facilities. Griffith Park is one of the largest city-owned parks in the world. It covers more than 4,000 acres (1,600 hectares). The park has about 50 miles (80 kilometers) of bridle paths and several baseball fields, golf courses, and tennis courts. The park also includes the Los Angeles Zoo and the Griffith Observatory and Planetarium.

The Greater Los Angeles area has six major professional sports teams—two baseball teams, two basketball teams, and two hockey teams. The Los Angeles Dodgers of the National League play baseball in Dodger Stadium. The Anaheim Angels of the American League play baseball in Edison International Field of Anaheim. The Staples Center in downtown Los Angeles is the home of three teams—the Los Angeles Lakers and the Los Angeles Clippers of the National Basketball Association and the Los Angeles Kings of the National Hockey League. The Mighty Ducks of Anaheim of the National Hockey League skate on the ice of Arrowhead Pond at Anaheim Arena.

Other spectator sports in the area include auto racing and horse racing. Los Angeles was the location for the Summer Olympic Games in 1932 and 1984.



Natural History Museum of Los Angeles County

La Brea tar pits display life-sized statues of animals that were trapped in layers of oil and tar in prehistoric times.



Tony Freeman, Photo Edit

A Spanish mission in Mission Hills is one of several missions built in the San Fernando Valley and San Gabriel by Franciscan friars during the late 1700's and early 1800's. The Franciscans established 21 missions in California, each about a day's walk from the next.



©Universal Studios, Hollywood. All rights reserved.

At Universal Studios in Universal City, visitors can tour a huge motion-picture studio and back lot. They can also enjoy rides and attractions based on movie themes, such as the flying bicycle ride, *above,* from the 1982 classic *E.T.: The Extra-Terrestrial.*

Visitor's guide

Each year, millions of tourists and delegates to conventions and trade shows visit the Los Angeles area. Following are descriptions of some of the interesting places to visit in and near the city. Other places of interest are discussed and pictured earlier in this article.

Beaches offer opportunities for recreation and sightseeing. Well-known beaches in the Los Angeles area include Malibu, Redondo, Santa Monica, and Venice.

Farmers Market is located near Hollywood. This shopping center consists of more than 100 stores and stalls that sell a wide variety of goods from alfalfa juice to Hawaiian sportswear.

La Brea tar pits, located in Hancock Park east of Beverly Hills, contain the bones of thousands of animals that were trapped in layers of oil and tar during prehistoric times. Life-sized statues of the trapped animals are exhibited. The George C. Page Museum, on the site, exhibits bones that have been dug up from the pits. See **La Brea tar pits**.

Spanish missions are in the San Fernando Valley and in San Gabriel. These missions are among the 21 picturesque missions that were built in California by Franciscan friars during the 1700's and early 1800's.

Universal Studios, in Universal City north of Hollywood, make up one of the largest movie-television studios. At Universal Studios, visitors take tours of the sets of motion pictures and television shows. There are also tours through action exhibits that are based on movies.

City Walk is a pedestrian promenade outside the studios. It offers elegant shopping, restaurants, and entertainment.

Government

Los Angeles's government consists of a mayor, 10 city departments, and a 15-member City Council. The people elect the mayor to a four-year term. The mayor may not serve more than two terms. The mayor administers the government and appoints the heads of the city departments. The mayor also appoints boards of commissioners to oversee most of the departments.

The City Council makes the laws of Los Angeles and approves the budget, which the mayor prepares. One council member is elected from each of 15 districts in the city. Members of the City Council are elected to four-year terms. Council members may not serve more than two terms.

Much of the council's work is done by its 15 standing committees. These committees recommend legislation to the full council. The mayor can *veto* (reject) legislation passed by the council. However, the City Council can *override* (set aside) the mayor's veto with a two-thirds majority vote of the council members present when the vote is taken.

The city of Los Angeles has a budget of more than $4 billion annually. Sources of the city's income include the property tax, a sales tax, license fees for businesses and professionals, and aid from the state government and the federal government.

A five-member County Board of Supervisors governs Los Angeles County. The members are elected to four-year terms in district elections. The county government administers certain programs, such as air pollution control and flood control, throughout the county. It also provides government services for areas of the county that do not belong to any city.

Other government units that operate within Los Angeles include the Board of Education, which supervises the Los Angeles Unified School District; the State Department of Transportation, which controls the construction of freeways in the area; the California Highway Patrol, which polices the area's freeways; and the Metropolitan Transportation Authority, which operates the area's public transportation system.

History

American Indians were the first people to live in what is now the Los Angeles area. During the 1500's, a branch of the Shoshone tribe lived in a village called Yang-na. The village lay along the Los Angeles River near what is now the downtown area.

Exploration. In 1542, Juan Rodríguez Cabrillo, a Portuguese explorer working for Spain, discovered Yang-na. Cabrillo noted the village on his map and then continued exploring the California coast.

No other explorers reported visiting the Los Angeles area until 1769. That year, Gaspar de Portolá, a Spanish Army captain, and Juan Crespi, a Franciscan priest, led an expedition from San Diego north to Monterey Bay. After the group reached Yang-na, Crespi wrote in his diary that the area was a "delightful place" and that it had all the features necessary for a large settlement. Crespi and Portolá named the area *Nuestra Señora la Reina de Los ángeles de Porciúncula,* meaning *Our Lady the Queen of the Angels of Porciúncula.* Porciúncula was a Roman Catholic chapel in Italy associated with Saint Francis of Assisi, the founder of the Franciscan order.



Tony Stone Images

The Los Angeles City Hall stands in the heart of the downtown area. The 27-story landmark was completed in 1928 and features streamlined architecture popular in that era. It is one of a group of government buildings that make up the Civic Center.

Settlement. Soon after the Portolá party left the site of Los Angeles, Spain began its efforts to colonize the area. The first step was to establish a mission there. In 1771, Franciscan priests built Mission San Gabriel Arcángel, just east of the future city of Los Angeles. The mission was one of 21 that the Franciscans built on and near the California coast. San Gabriel became an important agricultural, cultural, and religious center.

After San Gabriel was built, Felipe de Neve, the Spanish governor of California, selected Crespi's "delightful place" as the site for a new *pueblo* (town). De Neve sent soldiers into northern Mexico to offer free land, animals, tools, and money to anyone willing to move to the new settlement.

In February 1781, a group of pioneers gathered at Guaymas, Mexico, to begin the long journey to Los Angeles. They arrived on Sept. 4, 1781, and officially founded the Pueblo of Los Angeles. The settlers totaled 44 people—11 men, 11 women, and 22 children. The group consisted of Indians, blacks, Spaniards, and people of mixed white and Indian ancestry and mixed white and black ancestry.

Mexican rule. Los Angeles grew quickly, and by 1800 it had 315 residents. The town began as a farming community, but it soon became a cattle-raising center. Much of the land in the area was divided into huge ranches on which thousands of longhorns were raised. In 1821, Mexico gained its independence from Spain and took control of Los Angeles and the rest of California.

Under Mexican rule, Los Angeles and Monterey alternated as the capital of California. In 1826, Jedediah Smith, an American fur trapper, became the first white person to reach Los Angeles by land from the East. In 1841, the first group of overland settlers from the United States arrived in the area. Other groups soon followed. But Mexicans and Spaniards continued to make up most of Los Angeles's population.

War broke out between Mexico and the United States in May 1846. In August, U.S. troops captured Los Angeles. But the people rebelled, and the Americans were forced to leave the city in October. The United States recaptured the city in January 1847. Mexico lost the war and signed the Treaty of Guadalupe Hidalgo with the United States in 1848. Under the terms of the treaty, Mexico gave the California area to the United States.

Development and growth. On April 4, 1850, Los Angeles was incorporated as a city. Five months later, California became a state of the United States. Los Angeles had a population of 1,610 in 1850. The city grew rather slowly during the next 20 years. It had 4,385 people in 1860 and 5,728 in 1870. But with the coming of the railroads, Los Angeles's population soared.

In 1876, the Southern Pacific Railroad (now part of the Union Pacific Railroad) was completed between Los Angeles and San Francisco. It provided the city with a rail link to the rest of the United States through San Francisco. In 1885, the Atchison, Topeka and Santa Fe (now the Burlington Northern and Santa Fe) Railway provided a direct connection between the Los Angeles area and the Midwest. Competition between the Southern Pacific and the Atchison, Topeka and Santa Fe led to lower and lower fares, which brought more and more people to Los Angeles. In the spring of 1886, the fare from the Midwest to Los Angeles dropped to $1. Trainloads of people from the East and Midwest came to Los Angeles. The Los Angeles area, in turn, shipped trainloads of oranges and other farm products to the Midwest and East. By 1890, the city's population had climbed to more than 50,000. By 1900, the population had soared to more than 100,000.

In 1899, Los Angeles began to build a huge artificial harbor at San Pedro. The harbor was completed in 1914, the same year the Panama Canal was completed. Los Angeles quickly became a major seaport.

By the 1920's, tourism had become a big business in Los Angeles. Many tourists liked the climate so much they decided to become residents. The area's new motion-picture industry was booming. The oil industry, which had begun in the 1890's, was spurred by the discovery of rich new fields. Also during the 1920's, new aircraft plants opened, and factories began to manufacture furniture, pottery, tires, and other products.

The mid-1900's. Los Angeles's economy slumped during the Great Depression of the 1930's. But its population continued to grow as thousands of jobless and homeless people drifted into the area, hoping their luck would change. The city's economy recovered and reached new heights after the United States entered World War II in 1941. Hundreds of thousands of new residents flocked to the city to work in aircraft factories, shipyards, and other war plants. By the war's end in 1945, Los Angeles had more than 1 $\frac{1}{2}$ million people.

Los Angeles's spectacular population growth continued after World War II. Thousands of new homes were built and quickly covered the city's open spaces. By 1960, the population had risen to nearly 2 $\frac{1}{2}$ million.

Recent developments. Los Angeles today is a huge, thriving urban center. Its population is continuing to grow. But like other large cities, Los Angeles faces many problems. Periodic economic slumps occur. Unemployment is high among blacks and Hispanics, and the city has had racial and ethnic conflicts and gang violence.

Air pollution has been a serious problem in Los Angeles since the 1950's. On calm days, smoke from factories and exhaust fumes from automobiles collect near the ground and form a thick yellow haze called *smog.* Smog irritates the eyes and lungs and can kill plants. In 1989, a 20-year plan was adopted to reduce air pollution. The plan calls for restrictions on the use of gasoline-powered motor vehicles and on the amount of air pollutants in such products as paint and aerosol sprays.

Los Angeles also has a serious traffic problem. Most people commute in automobiles on the freeways because the city has limited public transportation. As a result, the freeways are often jammed. To help reduce congestion, Los Angeles has improved its bus service and begun a mass-transit rail system.

Since the early 1900's, Los Angeles has had to obtain huge amounts of water from distant places by way of aqueducts. The California Aqueduct, completed in 1973, brings water to Los Angeles from California's Sacramento Valley, 685 miles (1,102 kilometers) to the north. The city has passed various water conservation measures since the late 1980's.

In 1973, Thomas Bradley, a member of the City Council, was elected mayor of Los Angeles. He became the city's first African American mayor. Bradley was reelected in 1977, 1981, 1985, and 1989. He chose not to run for a sixth term as mayor.

In the early 1990's, police brutality and race relations became major concerns in Los Angeles. The most publicized incident involved Rodney G. King. King, a black motorist, was stopped after a pursuit and beaten by four white police officers in Los Angeles in 1991. The officers faced several criminal charges, including assault. Although the beating was recorded on videotape, a state jury in 1992 acquitted the four officers on all charges except one, which was later dropped. The trial was held in Simi Valley, a mainly white suburb of Los Angeles. No blacks served on the jury. The verdict set off several days of rioting, mainly in black areas of South-Central Los Angeles. The rioting resulted in 53 deaths, over 2,400 injuries, and more than $1 billion in property damage.

In 1993, a federal jury convicted two of the officers who beat King of violating his civil rights. They were each sentenced to 2 $\frac{1}{2}$ years in prison. The other two officers were acquitted on the same charges. In a civil lawsuit in 1994, another federal jury ordered the city of Los Angeles to pay King about $3 $\frac{3}{4}$ million in damages.



Reuters/Bettmann

A powerful earthquake struck Los Angeles on Jan. 17, 1994. The earthquake killed 57 people. It caused sections of freeways to collapse, including the section shown here.

During the 1992 riots, Reginald Denny, a white truck driver, was pulled from his truck and severely beaten by rioters. The beating was captured on videotape. Seven black men were arrested in connection with the beating. Three pleaded either guilty or no contest to various charges. One of them received a three-year prison term, and two received two years. One of the other men was convicted of felony mayhem on Denny and of assaulting four other victims. He was sentenced to 10 years in prison. The three others were convicted of lesser charges and sentenced to probation and community service.

Brush fires have plagued the Los Angeles area because it receives little rain. The area's long, dry summers turn the brush and grass in the hills around the city dry and brown, creating a severe fire hazard in the early fall. In 1961, brush fires swept through the Bel Air and Brentwood communities, destroying about 450 homes. In 1993, fires broke out in the Los Angeles suburbs of Altadena and Laguna Beach, and in the Calabasas, Malibu, and Topanga Canyon areas just west of Los Angeles. The fires killed 4 people and destroyed about 1,100 buildings in these and other nearby communities.

The city and its suburbs lie on an unstable part of the earth's crust. As a result, earthquakes sometimes occur. Most cause limited damage. But in 1971, an earthquake centered in San Fernando, just north of Los Angeles, caused 58 deaths and $511 million in property damage. In 1987, an earthquake centered in Whittier, east of the city, caused 8 deaths and $358 million in damage. In January 1994, a strong earthquake struck Los Angeles. It centered within the city limits—in the Northridge area of the San Fernando Valley section. It was the most powerful earthquake in the city's history. It caused 57 deaths. Damage estimates ranged above $20 billion. Sections of major freeways collapsed during the earthquake and were closed down for several months.

In January 1995 and again in March, powerful storms caused flooding in the Los Angeles area and other parts of California. The storms created widespread damage, much of it resulting from mudslides.

In 1999, voters approved a new city charter, which took effect in 2000. The charter expanded the mayor's powers, streamlined city departments, and increased local participation in government.

In 2002, a number of citizens in Hollywood and in the San Fernando Valley began campaigning for those districts to *secede* (withdraw) from Los Angeles and become independent cities. Secession supporters in each district argued that their community's needs were being overlooked by Los Angeles leaders. Kenneth Reich

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Motion picture
Pasadena
San Bernardino
San Juan Capistrano

Outline

Questions

What are some reasons for Los Angeles's population growth?
When did the railroad fare from the Midwest to Los Angeles cost $1? Why did it cost so little?
What is the role of the City Council's committees?
Why did Los Angeles have only one high-rise building before 1957?
What are some of Los Angeles's major problems?
Why has the Los Angeles metropolitan area been described as "a hundred suburbs in search of a city"?
What are Los Angeles's major ethnic groups?
What is the Hollywood Bowl? The Wilshire Center?
What country ruled Los Angeles and the rest of California from 1826 to 1848?

Lost Colony is the name given to a settlement established in 1587 on Roanoke Island, off the coast of what is now North Carolina. The colony is called *lost* because no one knows what happened to its people or where they went.

The Lost Colony was England's second colony in America. The first had been established on Roanoke Island by a group of 108 men sent to the island in 1585 by the English soldier and explorer Sir Walter Raleigh. The first colony was meant to serve chiefly as a base for repairing and resupplying English warships. But the colonists found that the seas around the island were too shallow for ships to seek shelter there. In addition, the land was not productive enough to support both the colony and the Indians already living there. As a result, the colonists returned to England in 1586.

A few days after the colonists left, a group of ships sent by Raleigh from England arrived at the island with supplies and more colonists. When the new colonists found that the others had left, most of them sailed back to England with the ships. However, 15 adventurers remained on the island.

In May 1587, Raleigh sent another group of colonists to America, to settle on the shores of Chesapeake Bay. These colonists became the lost colonists. They were led by John White, an Englishman who had been a member of the first colony.

In July 1587, the commander of the ships carrying the new colony refused to sail beyond Roanoke Island and forced the colonists to land there. When the colony landed, it consisted of 117 people—91 men, 17 women, and 9 children. Twenty-seven days later, on August 18, White's daughter, Eleanor, gave birth on the island to a baby girl. Named Virginia Dare, the baby was the first English child born in America. Her father, Ananias Dare, was also one of the colonists. Later in August, White returned to England for supplies. His daughter, granddaughter, and son-in-law remained on the island.

War between England and Spain prevented White from returning to Roanoke Island until August 1590. By the time he arrived, the colony had been abandoned. The only traces of the colonists were the letters *CRO* carved on one tree and the word *Croatoan* carved on another. The Croatoan, or Hatteras, Indians were friendly Indians who lived on an island south of Roanoke Island. Although the colonists had intended to go north by land to Chesapeake Bay, White decided to see if they had gone to live with the Croatoans. However, a storm and the lateness of the season forced White and his expedition to abandon their search and return to England. The lost colonists were never seen again by any European.

Some modern historians think that most of the lost colonists may have moved to Chesapeake Bay and perished there in conflicts with Indians. Stories collected by Virginians indicate that other members of the Lost Colony may have mingled with several Indian tribes. The Lumbee Indians, who live in southeastern North Carolina, believe themselves to be descendants of the lost colonists and of Indians who lived nearby (see **Lumbee Indians**). Karen Ordahl Kupperman

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Lost Generation is a term that has come to define a group of American writers who lived and rose to prominence in Europe during the 1920's. The principal figures in the group included Gertrude Stein, Ernest Hemingway, Ezra Pound, F. Scott Fitzgerald, E. E. Cummings, John Dos Passos, Thornton Wilder, and Hart Crane. These writers helped establish many of the stylistic and thematic foundations of modern literature.

Stein reportedly coined the term "lost generation." Hemingway used Stein's phrase "You are all a lost generation" in the preface to his novel *The Sun Also Rises* (1926). The novel describes the losses of traditional faith, values, and personal direction among a group of Americans living in Europe.

The Lost Generation writers were particularly associated with the unconventional art scene in Paris. These writers tended toward philosophic pessimism. They typically rejected what they considered to be the narrow-mindedness and materialism that followed the end of World War I in 1918. They also rejected the conventional literary techniques of the past. Arthur M. Saltzman

See also **American literature** (The lost generation); **Hemingway, Ernest; Stein, Gertrude.**

Lot, in the Book of Genesis, was the nephew of the patriarch Abraham. The two led their followers from the city of Ur in Mesopotamia to Canaan. There, they divided their company into groups (Genesis 13). Lot resided in the wicked city of Sodom. He unknowingly entertained two angels sent to destroy Sodom and the nearby city of Gomorrah. Later, Lot fled from Sodom with his wife and two daughters. His wife, defying the command they had been given, turned back to watch the destruction of the cities. She was immediately changed into a pillar of salt as punishment for her curiosity and disobedience (Genesis 19:26).

Lot's daughters despaired of finding husbands and therefore having children. They thus got their father drunk and had sexual relations with him. Two sons, called Moab and Ben-ammi, were born as a result. They were considered the ancestors of the Moabites and Ammonites in what is now the East Bank of the Jordan River.
Carole R. Fontaine

See also **Abraham; Sodom and Gomorrah.**

Lotharingia. See **Verdun, Treaty of.**

Lott, Trent (1941-), who represents Mississippi in the United States Senate, became the Senate Republican leader in June 1996. He gained the office when the Republican senators chose him as their leader to replace Robert J. Dole, who had resigned to run for president. Lott had been Republican Senate *whip* (assistant leader) since January 1995.

Lott served in the U.S. House of Representatives from 1973 to 1989. He was Republican House whip from 1981 to 1989. He was first elected to the Senate in 1988, and took office in 1989. In Congress, Lott became known for his aggressive leadership style and his conservatism. He opposed increases in federal taxes and worked to limit federal spending. He supported a strong military.

Lott, whose full name is Chester Trent Lott, was born in Grenada, Mississippi. He attended the University of Mississippi, where he earned a bachelor's degree in 1963 and a law degree in 1967. From 1968 to 1972, he

worked as an assistant to William M. Colmer, a Democratic member of the U.S. House of Representatives. Lott switched from the Democratic Party to the Republican Party in 1972. Jackie Koszczuk

Lottery is a popular form of gambling in which drawings are held for cash prizes. In most lotteries, people buy numbered tickets from authorized sellers or from vending machines. Winning numbers are determined at random in public drawings. Many countries run national lotteries as a means of raising revenue. In the United States, more than half the states and Washington, D.C., operate lotteries to supplement tax receipts. All 10 Canadian provinces have lotteries. Sales of lottery tickets raise billions of dollars each year.

There are various forms of lottery play. For example, depending on the game, players must match 3, 4, or more numbers to win. People may choose their own numbers or have a computer select numbers for them. Drawings may be held daily or one or more times a week. In "instant" lottery games, people buy "rub-off" tickets that may reveal immediate winners. In some state lottery games, players may win cash awards of millions of dollars. Winners of lottery prizes of $1 million or more usually receive payments over a period of several years. Lesser amounts of money are paid in one lump sum.

The Bible contains many references to the use of "lots" to settle disputes and divide property. Lotteries had become popular throughout Europe by the 1700's, and in the United States by the early 1800's. During the 1830's, many people began to oppose lotteries. State after state prohibited them, and legal lotteries were no longer held in the United States by 1894. But in 1964, New Hampshire revived lotteries in the United States when the first of the state-operated games was played.

Dwight Chuman

See also **Gambling**.

Lotus is the common name for many different kinds of plants. The lotus that is known in most places is the Egyptian water lily. The American lotus is also a well-known plant.

The Egyptian water lily is a familiar sight along the Nile River and neighboring streams. This plant has white or rose-purple flowers that may be 1 foot (30 centimeters) across. They grow on a weak stalk, 4 to 8 feet (1.2 to 2.4 meters) long, and rise only a little above the water. The leaves spread out on the water's surface.

The lotus was a sacred flower to the people of Egypt, India, and China. It is also the national flower of India. A species of the lotus appears in ancient Egyptian art.

The American lotus is a close relative of the East Indian lotus. It also is known as the *water chinquapin* and *yellow water lily*. Its yellow flowers and leaves are on stout stalks that stand 2 to 3 feet (61 to 91 centimeters) above the water. There is a large lotus bed in Grass Lake, about 50 miles (80 kilometers) northwest of Chicago. These plants cover about 600 acres (240 hectares), and make a wonderful sight in August. Other lotus beds are found near New York City, in Monroe, Mich., in southern California, and in the valleys of the Missouri and Mississippi rivers.

The scientific name *Lotus* has nothing to do with the common name *lotus*. It is a genus of the pea family and consists of about 100 species. The flowers are white, yellow, red, or purple, and have a shape and size resembling pea flowers.



WORLD BOOK illustration by Robert Hynes

The Egyptian lotus, often called a water lily, grows on the surface of rivers and streams. In some ancient cultures, the lotus was a sacred flower.

Scientific classification. The Egyptian, East Indian, and American lotuses are in the water lily family, Nymphaeaceae. The Egyptian is *Nymphaea lotus*. The East Indian is *Nelumbo nucifera*. The American is *Nelumbo lutea*. The genus *Lotus* is in the pea family, Fabaceae or Leguminosae. Thomas B. Croat

See also **Flower** (picture: Flowers of the tropics and subtropics; table: National flowers); **Trefoil**.

Lotus-eaters made up a race of people who were thought to live in North Africa. In ancient Greek mythology, lotus-eaters were called Lotophagi (pronounced *loh TAHF uh jy*). It was said that their only food was the fruit and blossoms of the lotus, or jujube tree. People who ate of this magical tree forgot their homeland and the ties of friendship and family. The Greek epic poem the *Odyssey* describes an encounter between the lotus-eaters and the Greek hero Odysseus (Ulysses in Latin). Lord Tennyson's poem "The Lotos-Eaters" is based upon this story (see **Odyssey**). Today, people who continually daydream or think of impractical ideas are sometimes called lotus-eaters. Cynthia W. Shelmerdine

Lotze, *LOHT suh,* **Rudolf Hermann** (1817-1881), was a German philosopher. He attempted to reconcile apparent conflicts between science and religion. Lotze influenced many thinkers of the 1800's, notably the American philosopher Josiah Royce.

Lotze supported the mechanical interpretation of nature as the indispensable method of scientific research. This interpretation explains nature in terms of mechanical causes. Lotze denied that any separate nonmechanical principle accounted for organic existence. However, he insisted that the mechanical interpretation of nature has limits and that people's moral values force them to think beyond scientific evidence. He formulated a theory in which nature acts according to a purpose and natural things have a spiritual character. Lotze believed the highest spiritual nature is a personal God, in whom all things exist. Lotze stated that God exercises His will

through mechanical causes and the laws of nature.

Lotze was born on May 21, 1817, in Bautzen, in what is now Germany. He taught philosophy at the University of Göttingen. Lotze wrote many books, including *Metaphysics* (1841), *Logic* (1843), *Microcosmus* (1856-1864), and *System of Philosophy* (1874-1879). W. W. Bartley III

Lou Gehrig's disease. See **Amyotrophic lateral sclerosis.**

Loudspeaker. See **Intercom; Speaker.**

Lough Neagh, *lahk NAY,* in Northern Ireland, is the largest lake in the United Kingdom. At its longest point, it is about 18 miles (29 kilometers) long. Its maximum width is about 15 miles (24 kilometers). It covers about 150 square miles (388 square kilometers). For location, see **Northern Ireland** (map).

Ten rivers flow into Lough Neagh, but only one river—the Lower Bann—flows out. The Lower Bann empties into the Atlantic Ocean, north of Lough Neagh. Lough Neagh has a flat bed that averages about 45 feet (14 meters) in depth. Lough Neagh attracts many wild fowl, including the rare whooper swan. The lake's many eels, salmon, and trout attract large numbers of fishing enthusiasts. Desmond A. Gillmor

Louis I, *LOO ee, LOO ihs,* or *lwee* (778-840), also called Louis the Pious, succeeded his father, Charlemagne, as ruler of a vast European empire in 814. The empire, based in present-day France, also included large parts of what are now Germany and Italy as well as other areas. Charlemagne had built and expanded the empire by conquering much of western Europe.

Louis was born in Chasseneuil, France. He was unable to pursue further expansion because of Viking and Muslim raids, internal revolts, and divisions among the nobility. In 830, a civil war broke out over how the empire should be divided among Louis's four sons. During the struggle, Louis was removed from the throne temporarily, from 833 to 834. Civil war, Louis's indecisiveness, and other problems gradually weakened government authority and helped cause the empire to break apart after Louis's death on June 20, 840. Bernard S. Bachrach

See also **Charlemagne; Verdun, Treaty of.**

Louis IX, *LOO ee, LOO ihs,* or *lwee* (1214-1270), was a French king known for his piety and judicial reforms. He is also called Saint Louis. Louis led two of the Crusades to the Holy Land and was *canonized* (made a saint) by Pope Boniface VIII in 1297. Louis IX belonged to the Capetian family of French kings.

Louis was born on April 25, 1214, in Poissy, France. He was the son of King Louis VIII and Blanche of Castile. Louis IX came to the throne at the age of 12. His mother ruled wisely on his behalf until he turned 21. As king, Louis established a code of conduct among his officials and expanded the role of the royal court in administering justice. But like other rulers of his day, he also persecuted Jews and people considered heretics by the Roman Catholic Church. Still, even many of Louis's enemies considered him a just ruler and bore him no ill will.

Louis led the Seventh Crusade, which lasted from 1248 to 1254. In 1250, Muslim forces in Egypt took him and most of his army prisoner. The Muslims released Louis and his troops later that year, after Louis agreed to give up a captured city and pay a ransom. Louis led the Eighth Crusade in 1270, but died on August 25 that year in northern Africa of natural causes. Sue Helder Goliber

See also **Crusades** (Other Crusades).

Louis XI, *LOO ee, LOO ihs,* or *lwee* (1423-1483), was king of France. Louis XI succeeded his father, Charles VII, in 1461. Known as the Spider, Louis laid the foundations for royal *absolutism* (unlimited power) in France.

Louis was born on July 3, 1423, in Bourges, France. While still a *dauphin* (crown prince), he plotted against his father. In 1446, he was exiled, and in 1456, he fled for his life. When he became king, Louis set out to break the power of the nobles, who were almost independent of royal control. Charles the Bold, Duke of Burgundy, led the nobles. After the duke was killed in battle in 1477, Louis seized most of his territory. In 1481, the king added Provence, Maine, and Anjou to his kingdom.

Louis used cruel methods to keep power. He made and broke laws and levied heavy taxes. But he also encouraged art and learning, helped industry and agriculture, opened roads and canals, and helped the poor obtain justice. He died on Aug. 30, 1483. Sue Helder Goliber

See also **France** (A period of wars).

Louis XII, *LOO ee, LOO ihs,* or *lwee* (1462-1515), became king of France in 1498 after the death of his cousin King Charles VIII. Louis was born on June 27, 1462, in Blois, France. He became known as the "father of his people" because he reformed France's system of justice and kept taxes low. Louis defined the powers of the courts and appointed judges from nobles of lower rank who had no involvement in royal politics. But Louis's foreign policy was reckless and unsuccessful. After gaining the throne, he claimed the Italian *duchy* (territory of a duke or duchess) of Milan and, later, the Kingdom of Naples. French forces took both territories but were driven from Italy completely in 1512. Louis died on Jan. 1, 1515. Sue Helder Goliber

Louis XIII, *LOO ee, LOO ihs,* or *lwee* (1601-1643), became king of France in 1610 when his father, King Henry IV, was assassinated. Louis's mother, Marie de Médicis, ruled for him until 1617. From 1624 to 1642, Louis ruled with the help of his chief prime minister, Cardinal Richelieu. The two men increased royal authority by curbing the rebelliousness of France's provinces and of the country's nobles and peasants. They also stripped the Huguenots (French Protestants) of their military power.

In 1635, Louis declared war on Spain, leading France into the Thirty Years' War (1618-1648) against the royal Habsburg (or Hapsburg) family of Spain and Austria. He died on May 14, 1643, before the war ended, and was succeeded by his son Louis XIV.

Louis XIII was born on Sept. 27, 1601, in Fontainebleau, France. He belonged to the Bourbon family of rulers. Donald A. Bailey

See also **Anne of Austria; Marie de Médicis; Richelieu, Cardinal; Thirty Years' War.**

Louis XIV, *LOO ee, LOO ihs,* or *lwee* (1638-1715), was king of France for 72 years, the longest reign in modern European history. He was called *"Dieudonné"* ("God-given"), "Grand Monarch," or "Louis the Great." Louis was an outstanding example of an absolute monarch. He reportedly boasted, *"L'état c'est moi"* ("I am the State"). These words express the spirit of a reign in which the king claimed the highest political authority. Louis chose the sun as his royal emblem, and he liked to be called *Le roi-soleil* (The Sun King). Under Louis XIV, France led Europe in art, literature, war, and statesmanship.

Louis was born at St.-Germain-en-Laye, France. He succeeded his father, Louis XIII, when he was only 4 years old. Louis XIV's mother, Anne of Austria, ruled on his behalf until 1651. She had great influence even after her son was declared old enough to rule. Cardinal Mazarin, Louis's godfather, served as chief minister.

In 1648, the Thirty Years' War came to an end. This war strengthened France and weakened the Habsburg (or Hapsburg) rulers of the Holy Roman Empire. But Mazarin was unpopular in France, and his policies led to several years of civil disturbances called the *Fronde.* Twice Mazarin had to flee from Paris, but finally in 1653 he put down the Fronde. Its failure strengthened the king's authority over the nobles.

When Mazarin died in 1661, Louis declared that he would be his own chief minister. He had received a thorough education for kingship. Mazarin had taught him to choose wise counselors. The greatest of Louis's ministers was Jean Baptiste Colbert. Colbert reorganized French finance and promoted economy and industry.

Louis supported writers and artists and played a part in the growth of French literature. Historians often describe his long reign as "the Century of Louis XIV."

Louis fought four major wars. His great aim was to make himself supreme in Europe. In the first three wars, fought between 1667 and 1697, Louis hoped to recapture all lands that had ever been under French rule. He gained important territories, but his aggressive moves led other countries to form alliances against him. In the fourth war, the War of the Spanish Succession (1701-1714), Louis fought to protect his grandson Philip V's right to be king of Spain. The War of the Spanish Succession left France exhausted.

Louis married Maria Theresa of Spain in 1660, but he was more attracted to mistresses. The most important mistress was Madame de Maintenon. He secretly married her after Maria Theresa died in 1683. Madame de Maintenon approved of Louis's harsh treatment of the French Protestants, who were called *Huguenots.* Since 1598, the Huguenots had enjoyed religious toleration and privileges under the Edict of Nantes. In 1685, Louis revoked this edict. The government persecuted the Huguenots savagely in an effort to compel them to change their religion. Many thousands of Huguenots fled the country. Those who left included numerous craftworkers and business people.

After 1685, Louis's reign was less glorious than in earlier years. Colbert, who died in 1683, could not prevent the king from fighting wars and plunging the country into debt. Louis built a magnificent palace at Versailles, where he and his court lived in luxury. To prevent uprisings among the nobles, Louis made them live at the palace at Versailles, and serve him personally. They continued to attend the king until his death in 1715. Louis was succeeded by Louis XV, his great-grandson.

Maarten Ultee

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Nantes, Edict of
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Detail of an oil painting on canvas (1701) by Hyacinthe Rigaud; the Louvre, Paris (SCALA/ Art Resource)

Louis XIV became king of France in 1643 and reigned for 72 years—longer than any other modern European monarch.

Louis XV, *LOO ee, LOO ihs,* or *lwee* (1710-1774), was a king of France who contributed to the decline of royal authority. During his reign, France fought a number of expensive and disastrous wars. Louis also led a scandalous personal life. For these reasons, many French people hated him, and his reign did much to bring on the French Revolution (1789-1799). Louis could see a disaster coming but made only feeble attempts to prevent it. Louis is often remembered for his remark, "After me, the deluge!"

Louis was born at Versailles, France. He succeeded his great-grandfather Louis XIV at the age of 5. His reign began peacefully, though the government had accumulated a large debt under Louis XIV. Philippe, Duke of Orléans, a relative of the young king, ruled on his behalf until 1723. In 1726, Louis's former tutor, André Hercule Cardinal de Fleury, became the real head of



Brown Bros.

Louis XV

the government. Fleury worked to revive the weak economy of France.

When Fleury died in 1743, the king announced that he would rule without a chief minister, as Louis XIV had done. But Louis XV was a weak king interested more in pleasure than in government. He also was influenced too much by his mistresses. For 20 years, one of them, Madame de Pompadour, dictated policies and appointed ministers. After she died in 1764, another mistress, Madame du Barry, dominated Louis. Louis's favorites looted the treasury and prevented reforms.

In 1725, Louis married Maria Leszczyńska, daughter of Stanislas I, the exiled king of Poland. France fought the War of the Polish Succession (1733-1738) in a vain attempt to restore Stanislas to his throne. France won Lorraine in this war. In the War of the Austrian Succession (1740-1748), France gained nothing. In the Seven Years' War (1756-1763), France lost to Britain most of its colonies in Canada and India. Maarten Ultee

See also **Du Barry, Madame; Mississippi Scheme; Pompadour, Marquise de.**

Louis XVI, *LOO ee, LOO ihs,* or *lwee* (1754-1793), was king of France until he was overthrown by the French Revolution in 1792. He succeeded his grandfather Louis XV in 1774. He was a man of personal virtue and good intentions, but he was a weak ruler with average abilities. He was more interested in pursuing his own interests, such as hunting, than in managing public affairs. In 1770, he married Marie Antoinette of Austria. Louis often relied on her poor advice.

Louis was born at Versailles, France. When he became king, he made Robert Turgot minister of finance and promised to support him in dealing with the public debt. Turgot met opposition when he tried to abolish some of the privileges of the nobles and higher clergy, and Louis dismissed him in 1776. The king then turned to Jacques Necker and promised to support him. But the new minister ran into opposition from the queen and certain nobles when he tried to make reforms. He was forced to resign in 1781. By this time, the king had lost the sympathy of his people. During this period, France helped the United States gain its independence from Great Britain in the Revolutionary War in America. The war with Britain increased France's national debt.

Louis was forced to recall Necker in 1788. Necker asked the king to call the Estates-General, or national assembly, which had not met since 1614. The meeting of the Estates-General in 1789 marked the beginning of the French Revolution. Louis pretended to sympathize with the revolution. But actually, influenced by the advice of his wife, he opposed it. In October 1789, he and his family were forced to move from Versailles and live under guard in the Tuileries palace in Paris.

In 1791, Louis and his family tried to flee from France, but they were arrested. People began to demand that Louis be dethroned. Rioters invaded the Tuileries in August 1792 and murdered the king's personal corps of bodyguards called the Swiss Guards. That year, the National Convention deposed the king and declared France a republic. Louis was tried for treason. He defended himself with dignity but was found guilty. Louis was guillotined on Jan. 21, 1793. Eric A. Arnold, Jr.

See also **French Revolution; Marie Antoinette; Swiss Guard.**



Detail of an oil painting on canvas (about 1780) by Antoine-François Callet; Chateau Versailles, France (Giraudon/ Art Resource)

Louis XVI ruled France when the French Revolution began, in 1789. He was executed for treason in 1793.

Louis XVII, *LOO ee, LOO ihs,* or *lwee* (1785-1795), a son of King Louis XVI and Marie Antoinette, was regarded as king of France by supporters of the French monarchy for two years during the French Revolution (1789-1799). His full name was Louis-Charles de France. Louis-Charles was born at Versailles, France. He became *dauphin* (crown prince) of France at the age of 4, after his older brother died at the start of the French Revolution. In August 1792, Paris revolutionaries overthrew the monarchy and imprisoned the boy and his family. Following the execution of his father Louis XVI in January 1793, an uncle of Louis-Charles proclaimed him King Louis XVII in defiance of those who supported the revolution. Louis's mother was executed in October of that year.

Although gravely ill, Louis spent most of the last months of his life in solitary confinement, under filthy and degrading conditions. He was buried in an unmarked grave. Louis is sometimes called the *lost dauphin.* Eric A. Arnold, Jr.

Louis XVIII, *LOO ee, LOO ihs,* or *lwee* (1755-1824), was the king of France known as "the Restoration King" because his reign restored the monarchy after the French Revolution.

Louis XVIII was born at Versailles, France. He was a younger brother of King Louis XVI. As the Count of Provence, he fled from France in 1791. That year, he set up a court in Koblenz, in what is now Germany, and issued proclamations against the revolution. His actions helped enrage the French people against King Louis XVI and led

to the king's execution. When King Louis XVII died in 1795, the count assumed the title of king. While Napoleon Bonaparte was in power (1799-1814), Louis lived in several countries in Europe. He spent the later years of his exile in Britain.


Culver
Louis XVIII

In 1814, after Napoleon was defeated, the allied powers allowed Louis to take the throne. He promised to rule as a constitutional monarch. In 1815, during the "Hundred Days" of Napoleon's return, Louis was driven from his throne. But he was restored after the Battle of Waterloo. Louis proclaimed a liberal constitution and sincerely followed moderate policies in his rule. He tried to follow a middle course between the liberals and the reactionaries, who wanted to wipe out all the changes made by the French Revolution. Eric A. Arnold, Jr.

Louis, *LOO ihs,* **Joe** (1914-1981), an American boxer, held the world heavyweight championship from 1937 to 1949. He had a longer reign than any other champion in any division in the history of boxing. His efficient style combined a steady forward movement with an accurate, two-fisted attack. He won 66 fights, including 49 by knockout, of which 10 were in the first round.

Louis was born on May 13, 1914, in Lafayette, Alabama. His given and family name was Joe Louis Barrow. He shortened his name to Joe Louis soon after he began boxing. Louis won the national Amateur Association Light Heavyweight Championship in 1934 and turned professional that year. He won his first 23 bouts, 19 of them by knockout, before losing to former heavyweight champion Max Schmeling in 1936. Louis won the title in June 1937 by knocking out James J. Braddock. He successfully defended his title 25 times, scoring 22 knockouts, including a first round knockout of Schmeling in a return bout in June 1938. Louis retired in 1949. He attempted a comeback in 1950 and 1951 before losing to Rocky Marciano in his final fight. Bert Randolph Sugar

See also **Braddock, James Joseph.**

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Louis Napoleon. See Napoleon III.

Louis Philippe, *LOO ee fuh LEEP* (1773-1850), was king of France from 1830 to 1848. He is often called *The Citizen King.* He was born on Oct. 6, 1773, in Paris, the eldest son of Philippe Égalité, Duke of Orléans. He sympathized with the liberal ideas of the French Revolution and joined the national guard at the beginning of the revolt. He became a lieutenant general and took part in the battles of Valmy, Jemappes, and Neerwinden. However, he later joined a plot against the republic and had to leave France.

In 1814, Louis Philippe returned to France and regained his large estates. He was proclaimed "Citizen King" of France after Charles X was forced to give up the throne in 1830. A week later Louis Philippe was made king. During his reign, he became unpopular with all classes of the French people. The *legitimists* opposed him because they were loyal to the descendants of Charles X. The liberals disliked his increasing suppression of disagreement.

Louis Philippe's reign was prosperous but uneventful, as his ministers pursued cautious policies. The Revolution of 1848 broke out partly because he refused to reform election laws. He was forced to give up his throne, and escaped to England. Peter N. Stearns

See also **July Revolution; Napoleon III; Thiers, Louis Adolphe.**

Louis the Pious. See Louis I.

Louisbourg, *LOO ihs BURG* or *LOO ee BURG,* Nova Scotia, was the site of an important French fortress in the 1700's. British and French forces fought two battles over the fort during the mid-1700's. Today, Louisbourg is a historic landmark and a small fish-processing center. It lies on the east coast of Cape Breton Island. For location, see **Nova Scotia** (political map).

The French founded Louisbourg in 1713 and named it for King Louis XIV. The settlement benefited from its location along trade routes and near rich cod-fishing waters. The French began building a fortress at Louisbourg in 1719 to assert their power in the region. Louisbourg developed into a strong trade and fishery center. Its civilian population grew to about 4,000.

The First Battle of Louisbourg occurred in 1745, during King George's War (1744-1748) between Britain and France. British colonists from New England attacked Louisbourg with the support of British naval forces. The French fortress surrendered less than seven weeks later. In 1748, the Treaty of Aix-la-Chapelle returned Louisbourg to the French.

During the next 10 years, the French rebuilt the town and its fortress. Louisbourg regained its strength as a trade and fishery center. In 1758, during the Seven Years' War (1756-1763), the British attacked again and won the Second Battle of Louisbourg. Two years later, the British demolished Louisbourg to prevent another French return.

The site remained in ruins for almost two centuries. The Canadian government established the Fortress of Louisbourg as a national historic site in 1928. It restored some of the ruins and built a museum to house relics in 1935 and 1936. Then in 1961, the Canadian government began the reconstruction of the town of Louisbourg. Today, visitors can see the fortress, streets, and homes of Louisbourg as they were in the 1700's. D. A. Sutherland

Louise, Lake. See Lake Louise.

Louise of Mecklenburg-Strelitz, *MEHK luhn burk SHTRAY lihts* (1776-1810) ruled Prussia, with her husband Frederick William III, from 1797 to 1810. Her beauty, generosity, and courage in the face of trouble made her popular with her people. She reigned during the time of Napoleon's attacks on Prussia and urged her timid husband to resist the French. After the Prussian defeat at the Battle of Jena, she appealed to Napoleon to spare her country but was unsuccessful. Louise was born on March 10, 1776, in Hanover, Germany. She was the daughter of Duke Charles of Mecklenburg-Strelitz. She married in 1793. Charles W. Ingrao



Ronny Paille

A baldcypress swamp in a Louisiana bayou displays Spanish moss hanging from tree branches. Most of what is now Louisiana was once part of an ancient bay of the Gulf of Mexico.

Louisiana *The Pelican State*

Louisiana, a southern state of the United States, lies where the mighty Mississippi River empties into the Gulf of Mexico. This important location has made Louisiana one of the country's busiest commercial areas. Water routes link the state with both the heart of America and lands across the sea.

The Mississippi tells the story of Louisiana's progress. In colonial days, traders and fur trappers traveled the river in canoes, hollowed-out logs, or flatboats. During the 1800's, colorful paddle-wheel steamboats brought cotton to New Orleans and Baton Rouge for shipment throughout the world. Today, tugboats push chains of river barges more than 1,000 feet (300 meters) long. New Orleans, Louisiana's largest city, ranks among the world's busiest ports. Ocean ships can travel about 250 miles (400 kilometers) up the river to Baton Rouge, the state capital.

White-columned mansions, built before the Civil War (1861-1865), symbolize Louisiana's past glory as a leader of the Old South. Oil and natural-gas wells are a vital part of today's scene. They represent Louisiana's greatest source of wealth. Industrial growth based on these minerals began during World War II (1939-1945), and it has continued for much of the time since then. In the 1960's, Louisiana became a major space age industrial center.

The life of Louisiana is based on a mixture of many peoples, cultures, and customs. The influence of the early French and Spanish settlers can be seen throughout the state, especially in the south. There live *Creoles,* descendants of the original settlers, and *Cajuns,* some of whose French ancestors came from Canada.

Millions of tourists come to Louisiana each year. People from all parts of the United States visit New Orleans for the city's festive carnival season and famous Mardi Gras. The visitors enjoy seeing the old French and Spanish section, where delicious food is served in world-famous restaurants. Tourists also listen to New Orleans-style jazz, in the area known as the *Cradle of Jazz.* The state's plentiful wildlife lures many hunters and nature lovers.

Louisiana was named by the French explorer René-Robert Cavelier, Sieur de la Salle. He traveled down the Mississippi River in 1682, and claimed the entire Mississippi River Valley for France. La Salle named the region Louisiana in honor of the French king, Louis XIV. A nickname for Louisiana is the *Pelican State,* because of the brown pelicans that were once numerous along the coast of the state. Louisiana is also known as the *Bayou State,* because of its many *bayous* (slow-moving inlets or outlets of lakes and rivers).

The contributors of this article are Harold A. Petersen, Associate Professor of History, University of Southwestern Louisiana, and Timothy F. Reilly, Associate Professor of Historical Geography, University of Southwestern Louisiana.

Interesting facts about Louisiana

WORLD BOOK illustrations by Kevin Chadwick

Three of the largest egret colonies in the United States are located in Louisiana. More than 40,000 cattle egrets can be found near Lake Evangeline. About 10,000 common egrets live near White Lake, and about 12,000 snowy egrets are in the Delta National Wildlife Refuge near Delacroix. In addition, one of the nation's largest heron colonies is located in Louisiana. Between 10,000 and 20,000 little blue herons live in the Lac Des Allemands region west of New Orleans.

More crayfish are produced in Louisiana than any other place in the world. A total of 87 per cent of all crayfish produced in the United States comes from Louisiana, where about 125,000 acres (51,000 hectares) are devoted to raising crayfish as a seafood delicacy.



Crayfish



Longest boxing match

The longest boxing match in history was held in New Orleans on April 6-7, 1893. Andy Bowen and Jack Burke battled for 110 rounds. The fight lasted 7 hours and 19 minutes, ending in a draw.

Tabasco sauce originated on Avery Island. The sauce was first made from tabasco peppers grown on Avery Island by the McIlhenny Company from seeds brought from Mexico. Tabasco has been the company's exclusive trademark since 1868.

The St. Louis Cathedral in New Orleans is the oldest cathedral in continuous use in the United States. It was originally built as a small parish church in 1716. The present structure is the third one built on the site. The oldest part of the present structure dates from 1794.



John Scowen, FPG

Downtown New Orleans rises along the Mississippi River. New Orleans is the largest city in Louisiana and one of the South's major centers of business, industry, and transportation.



C. C. Lockwood

Oyster boats unload at Violet. Louisiana is among the most important states in commercial fishing. Other leading Louisiana seafood products include menhaden and shrimp.



D. Donne Bryant

The Old State Capitol, *above left,* in Baton Rouge, was constructed in 1847. The buildings and grounds of Centroplex, a modern convention center, surround the old capitol.

Louisiana in brief

Symbols of Louisiana

The state flag was adopted in 1912, and the state seal was adopted in 1902. Both bear a mother pelican in a nest with three young pelicans. This design shows the state's role as the protector of its people and resources. The state motto, *Union, Justice, and Confidence,* appears on the flag and the seal.

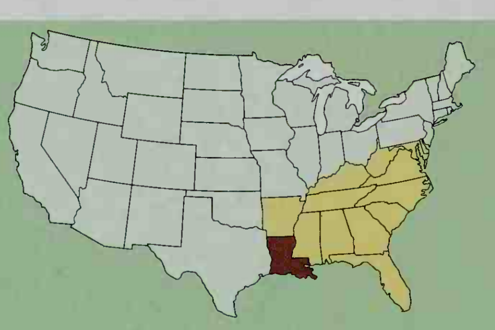




State flag



State seal



Louisiana (brown) ranks 31st in size among all the states and 6th in size among the Southern States (yellow).



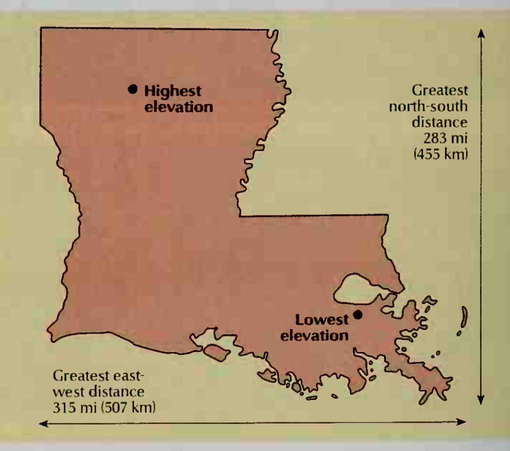
Baton Rouge has housed the State Capitol since 1882 and from 1849 to 1862. Other capitals were New Orleans (1812-1830, 1831-1849, 1862-1882) and Donaldsonville (1830-1831).

General information

Statehood: April 30, 1812, the 18th state.
State abbreviations: La. (traditional); LA (postal).
State motto: *Union, Justice, and Confidence.*
State songs: "Give Me Louisiana." Words and music by Doralice Fontane. "You Are My Sunshine." Words and music by Jimmy H. Davis and Charles Mitchell.

Land and climate

Area: 47,717 mi² (123,586 km²), including 4,153 mi² (10,757 km²) of inland water but excluding 1,931 mi² (5,002 km²) of coastal water.
Elevation: *Highest*—Driskill Mountain, 535 ft (163 m) above sea level. *Lowest*—5 ft (1.5 m) below sea level at New Orleans.
Coastline: 397 mi (639 km).
Record high temperature: 114 °F (46 °C) at Plain Dealing on Aug. 10, 1936.
Record low temperature: −16 °F (−27 °C) at Minden on Feb. 13, 1899.
Average July temperature: 82 °F (28 °C).
Average January temperature: 50 °F (10 °C).
Average yearly precipitation: 57 in (145 cm).



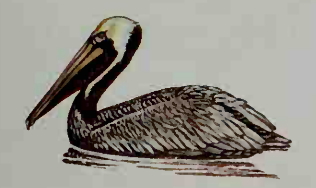
Important dates

1541 — Hernando de Soto led a Spanish expedition into the lower Mississippi River area.

1682 — La Salle reached the mouth of the Mississippi and claimed the river valley for France.

1714 — Louis Juchereau de St. Denis founded Natchitoches, the first permanent town in Louisiana.

1803 — The United States purchased Louisiana from France.



State bird
Brown pelican



State flower
Magnolia



State tree
Baldcypress

People

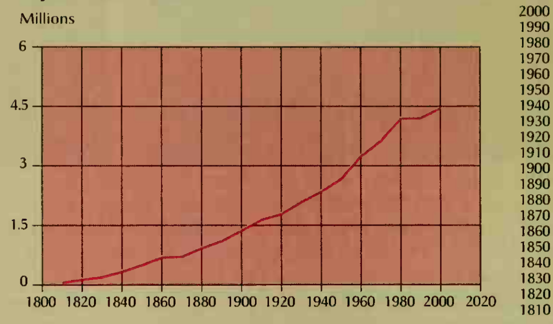
Population: 4,468,976 (2000 census)
Rank among the states: 21st
Population density: 94 per mi² (36 per km²), U.S. average 78 per mi² (30 per km²)
Distribution*: 68 percent urban, 32 percent rural

Largest cities in Louisiana

New Orleans	484,674
Baton Rouge	227,818
Shreveport	200,145
Metairie†	146,136
Lafayette	110,257
Lake Charles	71,757

†Unincorporated place.
Source: 2000 census, except for *, where figures are for 1990.

Population trend



Year	Population
2000	4,468,976
1990	4,238,216
1980	4,206,098
1970	3,644,637
1960	3,257,022
1950	2,683,516
1940	2,363,880
1930	2,101,593
1920	1,798,509
1910	1,656,388
1900	1,381,625
1890	1,118,588
1880	939,946
1870	726,915
1860	708,002
1850	517,762
1840	352,411
1830	215,739
1820	153,407
1810	76,556

Source: U.S. Census Bureau.

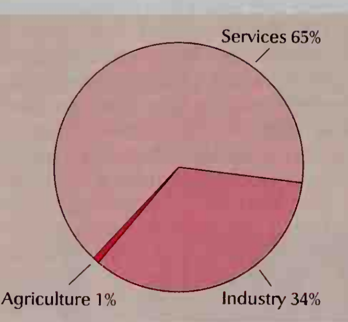
Economy

Chief products

Agriculture: cotton, broilers, rice, sugar cane, beef cattle, soybeans, milk.
Manufacturing: chemicals, petroleum products, food products, paper products, transportation equipment.
Mining: natural gas, petroleum.

Gross state product

Value of goods and services produced in 1998: $129,253,000,000. *Services* include community, business, and personal services; finance; government; trade; and transportation, communication, and utilities. *Industry* includes construction, manufacturing, and mining. *Agriculture* includes agriculture, fishing, and forestry.



Source: U.S. Bureau of Economic Analysis.

Government

State government

Governor: 4-year term
State senators: 39; 4-year terms
State representatives: 105; 4-year terms
Parishes: 64

Federal government

United States senators: 2
United States representatives: 7
Electoral votes: 9

Sources of information

For information about tourism, write to: Louisiana Office of Tourism, P.O. Box 94291, Baton Rouge, LA 70804-9291. The Web site at www.louisianatravel.com also provides information.
For information on the economy, write to: Department of Economic Development, P.O. Box 94185, Baton Rouge, LA 70804-9185.
The state's official Web site at www.state.la.us also provides a gateway to much information on Louisiana's economy, government, and history.

1812 Louisiana became the 18th state on April 30.
1879 The mouth of the Mississippi River was deepened so that large ocean ships could reach New Orleans.
1901 Oil was discovered near Jennings and White Castle.
1963 The Mississippi River-Gulf Outlet, a shortcut for ships between New Orleans and the sea, opened.
1975 A new state constitution went into effect.

People

Population. The 2000 United States census reported that Louisiana had 4,468,976 people. The population had increased about 6 percent over the 1990 figure, 4,219,973. According to the 2000 census, Louisiana ranks 22nd in population among the 50 states.

About three-fourths of the people of Louisiana live in metropolitan areas (see **Metropolitan area**). These areas include Alexandria, Baton Rouge, Houma, Lafayette, Lake Charles, Monroe, New Orleans, and Shreveport-Bossier City. For the population of these areas, see the *Louisiana map index.*

The state has 15 incorporated cities with more than 20,000 people. New Orleans is the largest city. Other large cities, in order of population, include Baton Rouge, Shreveport, Lafayette, Lake Charles, Kenner, and Bossier City. Large unincorporated areas include Metairie, Marrero, and Chalmette.

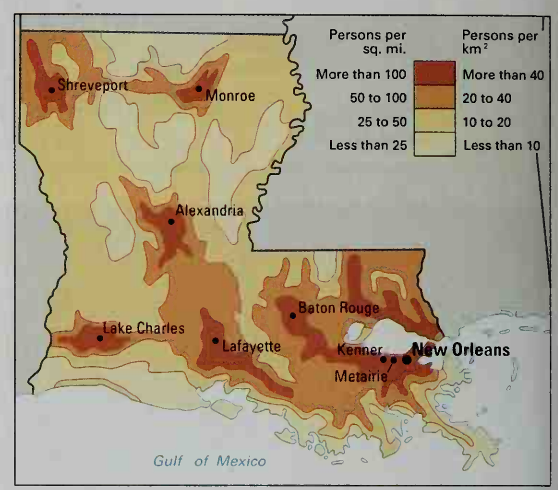
Louisianians often think of their state as having two parts—a French, Roman Catholic south and an Anglo-Saxon, Protestant north. Many southern Louisianians are descendants of the original French and Spanish settlers. They are called *Creoles.* Others, called *Cajuns,* are descendants of French settlers from the Acadia region of eastern Canada. Most northern Louisianians are of Anglo-Saxon descent. Their ancestors were pioneers who came from neighboring states. Blacks make up about 32 percent of the population of Louisiana.

The culture of the early French and Spanish settlers still has an important influence in southern Louisiana. Many of the people there speak both French and English. Until the early 1900's, state laws and official notices appeared in both languages. Some blacks living in remote areas speak a *dialect* (variation) of French called *Gumbo* or *Gombo.* Southern Louisiana has a reputation for fine cooking. Two major styles of cooking from that area are Creole and Cajun. Some famous dishes are *blackened redfish* (redfish served black in a mixture of spices), *huitres en coquille à la Rockefeller* (oysters baked on rock salt with spinach sauce), and *pompano en papillote* (pompano fish baked with shellfish sauce in a paper bag). Soups made with fish include *bisque* and *bouillabaisse.* Many New Orleanians flavor their strong, black coffee with chicory.

Schools. Louisiana's first schools were established in New Orleans during the early French rule of the area. Capuchin friars founded the first school about 1725. In 1727, Ursuline nuns started a girls' school that still exists. The Spanish colonial government opened the first pub-

Population density

About three-fourths of Louisiana's residents live in a metropolitan area, primarily in the southern half of the state. About 30 percent of the state's people live in metropolitan New Orleans.



WORLD BOOK map; based on U.S. Census Bureau data.

Sydney Byrd

Cajuns are descendants of French settlers from the Acadia region of eastern Canada. Many of them live in southern Louisiana. The women above are serving gumbo, a traditional Cajun dish.



D. Donne Bryant

The Café du Monde is a famous restaurant in the French Quarter of New Orleans. The historic French Quarter is named after the French colonists who first settled the area.



Sydney Byrd

A jazz band plays a spiritual as it leads a funeral procession to a cemetery in New Orleans. Jazz bands have traditionally played in such processions since the 1800's.



Louisiana State University

Louisiana State University in Baton Rouge is the state's largest university. Memorial Tower rises above the surrounding buildings on campus. It honors Louisiana's World War I dead.

lic school in 1772. However, the wealthier colonists preferred to send their children to private schools. Some wealthy people sent their sons to colleges in Europe or in the northern colonies. Many girls attended the Ursuline nuns' school or other local private schools.

Little progress in public education was made until the Constitution of 1845 created the office of state superintendent of education. Alexander Dimitry, the first superintendent of Louisiana, set up a statewide public school system. The state Constitution of 1898 provided the first effective financial support of the school system. The Constitution gave parish school districts the power to issue bonds in order to obtain educational funds.

A state Board of Elementary and Secondary Education controls public elementary and secondary schools and vocational technical institutes. The board has eight elected members and three members appointed by the governor with the approval of the state Senate. All board members serve four-year terms. A state superintendent of education, appointed by the board to a term of up to four years, administers the board's policies.

Louisiana has 66 local school districts. These districts consist of the state's 64 parishes plus two cities—Bogalusa and Monroe—that operate their own school systems. The voters of each district elect a school board, and the school board appoints a superintendent. Louisiana law requires children 7 through 16 years of age to attend school. However, a student may leave school after reaching the age of 16, with parental consent. For information on the number of students and teachers in Louisiana, see **Education** (table).

Libraries. A public subscription library was set up in New Orleans in 1805. In 1925, the Louisiana State Library in Baton Rouge began organizing parishwide public library systems, which now serve all 64 parishes. Louisiana has many academic and specialized libraries.

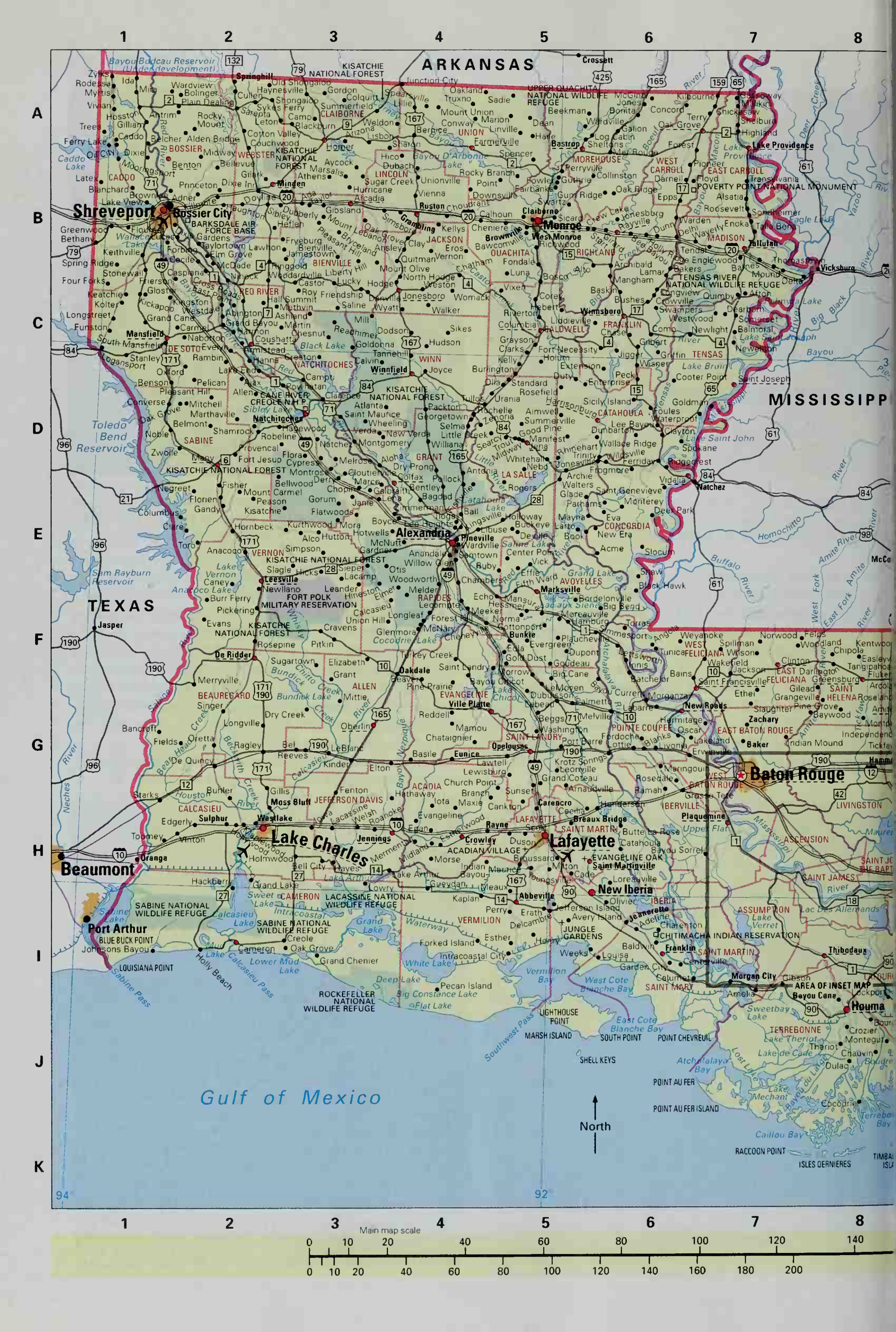
Museums. The Louisiana State Museum, founded in 1906, is the state's oldest and largest museum. It is housed in several historic structures, including eight buildings in the New Orleans French Quarter, the Old Courthouse Museum in Natchitoches, and the Wedell-Williams Aviation Museum in Patterson. The Cabildo in New Orleans, seat of the Spanish government, contains historic artwork and photographs. Displays about jazz are in the old U.S. Mint. The Presbytere houses exhibits about Mardi Gras. The New Orleans Museum of Art is one of the state's largest art museums. The National D-Day Museum in New Orleans displays artifacts from the Allied invasion of Normandy during World War II.

Universities and colleges

This table lists the universities and colleges in Louisiana that grant bachelor's or advanced degrees and are accredited by the Southern Association of Colleges and Schools.

Name	Mailing address
Centenary College of Louisiana	Shreveport
Dillard University	New Orleans
Grambling State University	Grambling
Louisiana, University of	*
Louisiana College	Pineville
Louisiana State University	†
Louisiana Tech University	Ruston
Loyola University New Orleans	New Orleans
McNeese State University	Lake Charles
New Orleans, University of	New Orleans
New Orleans Baptist Theological Seminary	New Orleans
Nicholls State University	Thibodaux
Northwestern State University	Natchitoches
Notre Dame Seminary, Graduate School of Theology	New Orleans
Our Lady of Holy Cross College	New Orleans
Our Lady of the Lake College	Baton Rouge
St. Joseph Seminary College	St. Benedict
Southeastern Louisiana University	Hammond
Southern University	‡
Tulane University	New Orleans
Xavier University of Louisiana	New Orleans

*Campuses at Lafayette and Monroe.
†For campuses, see Louisiana State University.
‡Campuses at Baton Rouge and New Orleans.



1 2 3 4 5 6 7 8
A B C D E F G H I J K
ARKANSAS
MISSISSIPPI
TEXAS
Gulf of Mexico
North
Shreveport
Bossier City
Monroe
Alexandria
Lake Charles
Lafayette
Baton Rouge
New Iberia
Houma
Beaumont
Port Arthur
Natchez
Vicksburg
Ruston
Minden
Natchitoches
Leesville
De Ridder
Opelousas
Crowley
Jennings
Sulphur
Abbeville
Morgan City
Thibodaux
Pineville
KISATCHIE NATIONAL FOREST
FORT POLK MILITARY RESERVATION
BARKSDALE AIR FORCE BASE
UPPER OUACHITA NATIONAL WILDLIFE REFUGE
TENSAS RIVER NATIONAL WILDLIFE REFUGE
POVERTY POINT NATIONAL MONUMENT
SABINE NATIONAL WILDLIFE REFUGE
LACASSINE NATIONAL WILDLIFE REFUGE
ROCKEFELLER NATIONAL WILDLIFE REFUGE
CHITIMACHA INDIAN RESERVATION
Toledo Bend Reservoir
Sam Rayburn Reservoir
Caddo Lake
Calcasieu Lake
Grand Lake
White Lake
Vermilion Bay
Atchafalaya Bay
MARSH ISLAND
ISLES DERNIERES
POINT AU FER ISLAND
AREA OF INSET MAP
Main map scale
0 10 20 40 60 80 100 120 140
0 10 20 40 60 80 100 120 140 160 180 200
94
92


Louisiana political map
Urban area
Park or other recreation area
Forest or other conservation area
Military or other federal area
State boundary
Parish boundary
WINN Parish name
State capital
Parish seat
City or town
Other federal area
Point of interest
Major airport
Waterway
Railroad
Highways:
Expressway
Other road
Interstate
U.S.
Other
Lambert conformal conic projection; WORLD BOOK maps
Inset map scale
100 Miles
Kilometers 160
300 Miles
450 Kilometers
Baton Rouge
New Orleans
Metairie
Kenner
Denham Springs
Port Allen
WEST BATON ROUGE
EAST BATON ROUGE
Livingston
Albany
Hammond
Natalbany
Robert
Covington
Abita Springs
SAINT TAMMANY
Talisheek
Picayune
BOGUE CHITTO NATIONAL WILDLIFE REFUGE
MISSISSIPPI
TANGIPAHOA
Ponchatoula
LIVINGSTON
Plaquemine
IBERVILLE
Gonzales
ASCENSION
Donaldsonville
Mandeville
Lacombe
Slidell
Lake Maurepas
Lake Pontchartrain
PONTCHARTRAIN CAUSEWAY
SAINT JOHN THE BAPTIST
Laplace
Reserve
Lake Borgne
Intracoastal Waterway
ORLEANS
SAINT JAMES
Lac Des Allemands
ASSUMPTION
Lake Verret
SAINT MARTIN
Thibodaux
LAFOURCHE
Raceland
Morgan City
TERREBONNE
SAINT CHARLES
Lake Cataouatche
JEFFERSON
Gretna
Chalmette
Arabi
Harahan
Westwego
Marrero
Belle Chasse
JEAN LAFITTE NATIONAL HISTORICAL PARK AND PRESERVE
SAINT BERNARD
Lake Salvador
PLAQUEMINES
Mississippi River Gulf Outlet
ALABAMA
FLORIDA
Mobile
Mobile Bay
Pensacola
Perdido Bay
Biloxi
Gulfport
Pascagoula
Mississippi Sound
Gulf of Mexico
30° North Latitude
88° West Longitude
90°
CHANDELEUR ISLANDS
Chandeleur Sound
BRETON NATIONAL WILDLIFE REFUGE
Breton Sound
DELTA NATIONAL WILDLIFE REFUGE
THE MISSISSIPPI DELTA
West Bay
East Bay
Grand Isle
Barataria Bay
WASHINGTON
Bogalusa

Louisiana map index

Metropolitan areas

Alexandria 126,337
Baton Rouge 602,894
Houma 194,477
Lafayette 385,647
Lake Charles 183,577
Monroe 147,250
New Orleans 1,337,726
Shreveport-Bossier City 392,302

Parishes (Counties)

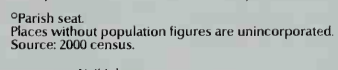
Acadia 58,861 G 4
Allen 25,440 F 3
Ascension 76,627 H 7
Assumption 23,388 I 7
Avoyelles 41,481 E 5
Beauregard 32,986 G 2
Bienville 15,752 B 3
Bossier 98,310 A 2
Caddo 252,161 B 1
Calcasieu 183,577 H 2
Caldwell 10,560 C 5
Cameron 9,991 H 3
Catahoula 10,920 D 6
Claiborne 16,851 A 3
Concordia 20,247 E 6
De Soto 25,494 C 2
East Baton Rouge 412,852 G 7
East Carroll 9,421 B 7
East Feliciana 21,360 F 7
Evangeline 35,434 G 4
Franklin 21,263 C 6
Grant 18,698 D 4
Iberia 73,266 I 6
Iberville 33,320 H 6
Jackson 15,397 B 4
Jefferson 455,466 I 9
Jefferson Davis 31,435 H 3
Lafayette 190,503 H 5
Lafourche 89,974 I 8
La Salle 14,282 D 5
Lincoln 42,509 B 4
Livingston 91,814 H 8
Madison 13,728 B 7
Morehouse 31,021 A 5
Natchitoches 39,080 D 3
Orleans 484,674 H 10
Ouachita 147,250 B 5
Plaquemines 26,757 J 11
Pointe Coupee 22,763 G 6
Rapides 126,337 F 4
Red River 9,622 C 2
Richland 20,981 B 5
Sabine 23,459 D 2
St. Bernard 67,229 I 10
St. Charles 48,072 I 9
St. Helena 10,525 G 8
St. James 21,216 H 8
St. John the Baptist 43,044 H 8
St. Landry 87,700 G 5
St. Martin 48,583 H 5
St. Mary 53,500 I 6
St. Tammany 191,268 H 10
Tangipahoa 100,588 G 9
Tensas 6,618 C 7
Terrebonne 104,503 J 7
Union 22,803 A 4
Vermilion 53,807 I 4
Vernon 52,531 E 2
Washington 43,926 G 9
Webster 41,831 A 2
West Baton Rouge 21,601 G 7
West Carroll 12,314 A 6
West Feliciana 15,111 F 6
Winn 16,894 C 4

Cities, towns, and other populated places

Abbeville° 11,887 I 5
Abita Springs 1,957 A 14
Acme E 6
Ada B 3
Addis 2,238 A 9
Adner B 2
Afton C 7
Ajax D 2
Albany 865 A 12
Alco E 3
Alden Bridge A 2
Alexandria° 46,342 E 4
Allen D 2
Aloha D 3
Alsatia B 7
Alto B 5
Amelia† 2,423 I 7
Amite° 4,110 G 8
Anacoco 866 E 2
Anandale E 4
Angie 240 F 10
Ansley B 4
Antonia D 4
Antrim A 2
Arabi† 8,093 C 14
Arcadia° 3,041 B 3
Archibald B 6
Archie D 5
Arcola F 8
Arizona A 3
Armistead C 2
Arnaudville 1,398 G 5
Ashland 291 C 3
Athens 262 B 3
Atlanta 150 D 3
Avery Island I 5
Avondale*† 5,441 D 14
Aycock A 3
Bagdad E 4
Bains F 6
Baker 13,793 G 7
Baldwin 2,497 I 6
Ball 3,681 E 4
Bancroft G 1
Baptist A 12
Barataria† 1,333 E 14
Basile 1,660 G 4
Baskin 188 C 6
Bastrop° 12,988 A 5
Batchelor F 6
Baton Rouge° 227,818 G 7
Bawcomville B 5
Bayou Cane† 17,046 I 8
Bayou Chicot F 4
Bayou Current F 6
Bayou Goula B 9
Bayou Sorrel H 7
Bayou Vista† 4,351 E 9
Baywood G 8
Beaver F 4
Bee Bayou B 6
Beekman A 5
Beggs G 5
Bel G 3
Belcher 272 A 1
Bell City H 3
Belle Chasse† 9,848 D 15
Belle Rose† 1,944 C 10
Bellevue B 2
Bellwood D 2
Benson D 1
Bentley E 4
Benton° 2,035 A 1
Bernice 1,809 A 4
Bertrandville D 14
Berwick 4,418 E 9
Bethany B 1
Bienville 262 B 3
Big Bend F 6
Big Cane F 5
Blackburn A 3
Black Hawk F 6
Blanchard 2,050 B 1
Blanks G 6
Bogalusa 13,365 F 10
Bohemia J 10
Bolinger A 2
Bolivar F 9
Bonita 335 A 6
Book E 5
Boothville J 11
Boothville-Venice*† 2,220 J 11
Bordelonville F 5
Bosco C 5
Bossier City 56,461 B 2
Bourg J 8
Boutte† 2,181 D 13
Boyce 1,190 E 4
Braithwaite D 15
Branch G 4
Breaux Bridge 7,281 H 5
Bridge City*† 8,323 D 14
Broadmoor* H 5
Broussard 5,874 H 5
Brownfields*† 5,222 A 9
Brownlee B 1
Brownsville-Bawcomville*† 7,616 B 5
Brownville B 5
Brusly 2,020 A 9
Bryceland 114 B 3
Buhler H 2
Bunkie 4,662 F 5
Buras J 11
Buras-Triumph*† 3,358 J 11
Burr Ferry F 2
Burrwood K 11
Bush G 10
Bushes C 6
Caddo A 1
Cade H 5
Calcasieu F 4
Calhoun B 4
Calumet I 6
Calvin 236 C 3
Cameron†° 1,965 I 2
Camp A 3
Campti 1,057 D 3
Caney E 2
Cankton 362 H 5
Carencro 6,120 H 5
Carlisle E 15
Carlyss*† 4,049 H 2
Carmel C 2
Carville B 10
Caspiana C 2
Castor 209 C 3
Catahoula H 6
Cecile B 2
Cecilia† 1,505 H 5
Center Point E 5
Centerville I 6
Central C 11
Chackbay† 4,018 D 11
Chalmette†° 32,069 C 15
Chambers E 4
Charenton† 1,944 I 6
Chase C 6
Chataignier 383 G 4
Chatham 623 C 4
Chauvin† 3,229 J 8
Chef Menteur C 15
Cheneyville 901 F 4
Cheniere B 5
Chestnut C 3
Chickasaw A 7
Chitimacha Indian Reservation 409 I 6
Chopin E 3
Choudrant 582 B 4
Church Point 4,756 G 5
Claiborne† 9,830 B 5
Clare E 2
Clarence 516 D 3
Clarks 1,071 C 5
Clay B 4
Clayton 858 D 6
Clifton F 9
Clinton° 1,998 F 7
Cloutierville D 3
Cocodrie J 8
Colfax° 1,659 D 4
Collinston 327 B 6
Colquitt A 3
Columbia° 477 C 5
Columbus E 2
Como C 6
Concord A 6
Convent° C 11
Converse 400 D 1
Conway A 4
Cooter Point D 6
Corey C 5
Cotton Valley 1,189 A 2
Cottonport 2,316 F 5
Couchwood A 2
Coushatta° 2,299 C 2
Coushatta Indian Reservation 25 G 3
Covington° 8,483 A 14
Cravens F 3
Creole I 3
Creston C 3
Crew Lake B 5
Cross Roads C 2
Crowley° 14,225 H 4
Crowville C 6
Crozier J 8
Cullen 1,296 A 2
Cut Off† 5,635 J 9
Cypress D 3
Dalcour D 15
Danville C 3
Darlington F 8
Darnell B 6
Darrow C 10
Davant J 10
Deer Park E 6
Delacroix D 16
Delcambre 2,168 I 5
Delhi 3,066 B 6
Delta 239 C 7
Denham Springs 8,757 A 10
De Quincy 3,398 G 2
De Ridder° 9,808 F 2
Derry D 3
Des Allemands† 2,500 D 12
Destrehan*† 11,260 C 13
Deville† 1,007 E 5
Diamond J 10
Dixie A 1
Dixie Gardens B 2
Dixie Inn 352 B 2
Dodson 357 C 4
Donaldsonville° 7,605 C 10
Donner E 10
Downsville 118 B 4
Doyline 841 B 2
Dry Prong 421 D 4
Dubach 800 B 4
Dubberly 290 B 3
Dubuisson F 5
Dulac† 2,458 J 8
Dunbarton D 6
Dunn B 6
Dupont F 5
Duson 1,672 H 5
Easleyville F 8
East Hodge* 366 C 4
East Point C 2
Eastwood*† 3,374 B 2
Echo F 5
Eden Isle*† 6,261 B 15
Edgard†° 2,637 C 12
Edgefield* 190 C 2
Edgerly H 2
Effie E 5
Egan H 4
Elizabeth 574 F 3
Elm Grove B 2
Elmer F 4
Elton 1,261 G 4
Empire† 2,211 J 10
Englewood B 7
Enoka B 7
Enterprise D 5
Eola F 5
Epps 1,153 B 6
Erath 2,187 I 5
Eros 202 B 4
Erwinville G 6
Estelle*† 15,880 D 14
Esther I 5
Estherwood 807 H 4
Ethel F 7
Eunice 11,499 G 4
Evangeline H 4
Evelyn C 2
Evergreen 314 F 5
Extension C 6
Fairbanks B 5
Farmerville° 3,808 A 4
Fenton 380 G 3
Ferriday 3,723 D 6
Ferry Lake A 1
Fifth Ward F 5
Fillmore B 2
Fisher 268 E 2
Fishville E 4
Flatwoods E 3
Flora D 3
Florien 692 E 2
Flournoy B 1
Floyd B 6
Fluker F 8
Folsom 525 G 9
Fondale B 5
Forbing B 1
Fordoche 933 G 6
Forest 275 A 6
Forest Hill 456 F 4
Forked Island I 4
Fort Jesup D 2
Fort Necessity C 6
Fort Polk North*† 3,279 F 3
Fort Polk South*† 11,000 F 3
Foules D 6
Four Forks C 1
Fowler B 5
Franklin° 8,354 I 6
Franklinton° 3,657 F 9
French Settlement 945 B 11
Frenier C 13
Friendship C 3
Frierson C 2
Frogmore D 6
Frost A 11
Fryeburg B 3
Funston C 1
Galbraith E 3
Galion A 6
Galliano† 7,356 J 9
Galva B 13
Garden City I 6
Gardere*† 8,992 A 9
Gardner E 4
Garyville† 2,775 C 12
Gassoway A 7
Geismar B 10
Georgetown 301 D 4
Gheens J 9
Gibsland 1,119 B 3
Gibson J 7
Gilark B 2
Gilbert 561 C 6
Gilead F 8
Gilliam 178 A 1
Gillis G 2
Girard B 6
Glade E 5
Glenmora 1,558 F 4
Gold Dust F 5
Golden Meadow 2,193 J 9
Goldman D 7
Goldonna 457 C 3
Gonzales 8,156 B 10
Good Pine D 5
Gordon A 3
Gorum E 3
Grambling 4,693 B 4
Gramercy 3,066 C 11
Grand Bayou C 2
Grand Cane 191 C 1
Grand Chenier I 3
Grand Coteau 1,040 G 5
Grand Isle 1,541 J 10
Grand Lake H 2
Grangeville G 8
Grant F 3
Gray† 4,958 E 11
Grayson 531 C 5
Greensburg° 631 F 8
Greenwood 2,458 B 1
Gretna° 17,423 D 14
Griffin C 6
Grosse Tete 670 G 6
Gueydan 1,598 H 4
Guthrie B 5
Hackberry† 1,699 H 2
Hagewood D 3
Hahnville†° 2,792 C 13
Haile A 5
Hall Summit 264 C 2
Hamburg F 5
Hammond 17,639 G 8
Hanna C 2
Harahan 9,885 C 14
Harmon C 2
Harrisonburg° 746 D 6
Harvey*† 22,226 D 14
Hathaway G 4
Haughton 2,792 B 2
Hayes H 3
Haynesville 2,679 A 3
Head of Island B 11
Hebert C 5
Heflin 245 B 2
Henderson 1,531 H 6
Henry I 5
Hermitage G 7
Hessmer 642 F 5
Hickory A 15
Hicks E 3
Hico A 4
Highland A 7
Hineston E 3
Hodge 492 C 4
Holden A 12
Holloway E 5
Holly Beach I 2
Holly Ridge B 6
Hollywood H 2
Holmwood H 3
Holton G 9
Holum C 5
Homer° 3,788 A 3
Hornbeck 435 E 2
Hosston 387 A 1
Hotwells E 4
Houma° 32,393 J 8
Hudson C 4
Hurricane B 3
Husser G 9
Hutton E 3
Iberville B 10
Ida 258 A 1
Independence 1,724 G 8
Indian Bayou H 4
Indian Mound G 7
Innis F 6
Inniswold*† 4,944 A 10
Intracoastal City I 5
Iota 1,376 H 4
Iowa 2,663 H 3
Jackson 4,130 F 7
Jamestown 149 B 3
Janie E 3
Jean Lafitte 2,137 E 14
Jeanerette 5,997 I 6
Jefferson† 11,843 C 14
Jefferson Island I 5
Jena° 2,971 D 5
Jennings° 10,986 H 4
Jesuit Bend D 14
Jigger C 6
Johnsons Bayou I 1
Jones A 6
Jonesboro° 3,914 C 4
Jonesburg B 6
Jonesville 2,469 D 6
Joyce C 4
Junction City 652 A 4
Kaplan 5,177 H 4
Keatchie 323 C 1
Keithville B 1
Kelly C 5
Kellys B 4
Kenner 70,517 C 13
Kentwood 2,205 F 8
Kickapoo C 1
Kilbourne 436 A 7
Killian 1,053 A 12
Kinder 2,148 G 3
Kingston C 1
Kingsville E 4
Kisatchie E 3
Kolter C 1
Kraemer D 11
Krotz Springs 1,219 G 6
Kurthwood E 3
Labadieville† 1,811 D 10
Labarre G 6
Lacamp E 3
Lacassine H 3
Lacombe† 7,518 B 15
Lafayette° 110,257 H 5
Lafitte† 1,576 I 9
Lake Arthur 3,007 H 4
Lake Charles° 71,757 H 2
Lake End C 2
Lake Providence° 5,104 A 7
Lake View B 1
Lakeland G 6
Lamar B 6
Laplace† 27,684 C 12
Larose† 7,306 J 9
Larto E 5
Latex B 1
Lawhon B 3
Lawtell G 5
Leander E 3
Lebeau G 5
LeBlanc G 3
Lecompte 1,366 F 4
Lee Bayou D 6
Lee Heights E 4
Lees Landing A 13
Leesville° 6,753 E 2
Leeville J 9
LeMoyen F 5
Lena E 3
Leonville 1,007 G 5

Place	Population	Map key	
Leton		A	2
Lettsworth		F	6
Lewisburg		G	5
Libuse		E	4
Liddieville		C	5
Lillie	139	A	4
Linville		A	5
Lisbon	162	A	3
Little Creek		D	4
Livingston°	1,342	A	11
Livonia	1,339	G	6
Lockport	2,624	I	8
Log Cabin		A	5
Logansport	1,630	C	1
Lone Star		C	9
Longleal		F	4
Longstreet	163	C	1
Longview		C	6
Longville		G	2
Loranger		G	9
Loreauville	938	H	6
Lottie		G	6
Louisa		I	6
Lucas		B	2
Lucky	355	C	3
Luling†	11,512	D	13
Luna		C	5
Lutcher	3,735	C	11
Lydia*†	1,079	I	5
Madisonville	677	A	14
Mamou	3,566	G	4
Manchac		B	13
Mandeville	10,489	A	14
Mangham	595	C	6
Manifest		D	5
Mansfield°	5,582	C	1
Mansura	1,573	F	5
Many°	2,889	D	2
Maplewood		H	2
Maringouin	1,262	G	6
Marion	806	A	5
Marksville°	5,537	F	5
Marrero†	36,165	D	14
Marsalis		B	3
Marthaville		D	2
Martin	625	C	3
Mathews†	2,003	D	14
Maurepas		B	12
Maurice	642	H	5
Maxie		H	4
Mayna		E	5
McDade		B	2
McGinty		A	6
McNary	211	F	4
McNutt		E	4
Meaux		H	5
Melder		F	4
Melrose		D	3
Melville	1,376	G	6
Mer Rouge	721	A	6
Meraux†	10,192	D	15
Mermentau	721	H	4
Merrydale*†	10,427	A	9
Merryville	1,126	F	2
Metairie†	146,136	C	14
Methvin		C	2
Midland		H	4
Midway		A	2
Midway	1,505	D	5
Mill		C	3
Millikin		A	7
Milton		H	5
Mimosa Park*		D	13
Minden°	13,027	B	2
Mira		A	1
Mitchell		D	2
Mittie		G	3
Monroe°	53,107	B	5
Montegut†	1,803	J	8
Monterey		E	6
Montogomery	787	D	3
Monticello*†	4,763	A	10
Montpelier	214	G	8
Montrose		D	3
Mooringsport	833	A	1
Mora		E	3
Moreauville	922	F	5
Morgan City	12,703	I	7
Morganza	659	G	6
Morrow		F	5
Morse	759	H	4
Moss Bluff†	10,535	H	2
Mound	12	C	7
Mount Carmel		E	2
Mount Hermon		F	9
Mount Lebanon	73	B	3
Mount Olive		B	3
Myrtle Grove		J	10
Naborton		C	2
Nairn		J	10
Naomi		E	15
Napoleonville°	686	D	10
Natalbany†	1,739	A	12
Natchez	583	D	3
Natchitoches°	17,865	D	3
Nebo		D	5
Negreet		E	2
New Era		E	6
New Iberia°	32,623	H	5
New Orleans°	484,674	I	9
New Roads°	4,966	G	6
New Sarpy†	1,568	C	13
New Verda		D	3
Newellton	1,482	C	7
Newlight		C	6
Newllano	2,415	F	2
Ninock		C	2
Noble	259	D	1
Norco†	3,579	C	13
Norma		F	5
North Hodge	436	C	4
Norwood	337	F	7
Oak Grove°	2,174	A	7
Oak Grove		B	3
Oak Grove		D	2
Oak Grove		I	3
Oak Hills*†	7,996	A	9
Oak Ridge	142	B	6
Oakdale	8,137	F	4
Oakland		A	4
Oberlin°	1,853	G	3
Oil City	1,219	A	1
Old Jefferson*†	5,631	A	10
Old Shongaloo		A	2
Olivier		H	6
Olla	1,417	D	5
Opelousas°	22,860	G	5
Oretta		G	2
Oscar		G	6
Otis		E	4
Oxford		C	2
Packton		D	4
Paincourtville†	884	C	10
Palmetto	188	G	5
Paradis†	1,252	D	13
Parhams		E	6
Parks	533	H	5
Patterson	5,130	E	9
Pearl River	1,839	A	16
Peason		E	2
Pecan Island		I	4
Peck		D	6
Pelican		D	2
Perry		I	5
Perryville		B	5
Phoenix		I	10
Pickering		F	2
Pierre Part†	3,239	C	9
Pigeon		C	9
Pilottown		K	11
Pine		F	9
Pine Grove		G	8
Pine Prairie	1,087	F	4
Pineville	13,829	E	4
Pioneer	171	A	6
Pitkin		F	3
Plain Dealing	1,071	A	2
Plaquemine	7,064	H	7
Plattenville		C	10
Plaucheville	281	F	5
Pleasant Hill	786	D	2
Point		B	5
Pointe-a-la-Hache°		J	10
Pollock	376	E	4
Ponchatoula	5,180	A	13
Port Allen°	5,278	A	9
Port Barre	2,287	G	5
Port Eads		K	11
Port Sulphur†	3,115	J	10
Port Vincent	463	A	11
Powhatan	141	D	3
Poydras*†	3,886	D	15
Prairieville		B	10
Prien*†	7,215	H	2
Princeton		B	2
Provencal	708	D	2
Quimby		C	7
Quitman	168	B	4
Raceland†	10,224	E	12
Ragley		G	2
Raman		G	6
Rambin		C	2
Rayne	8,552	H	4
Rayville°	4,234	B	6
Readhimer		C	3
Red Chute*†	5,984	B	2
Reeves	209	G	3
Reggio		D	16
Remy		C	11
Reserve†	9,111	C	12
Rhinehart		D	5
Richmond*	499	C	7
Richwood	2,115	B	5
Ridgecrest	801	D	6
Ringgold	1,660	B	2
River Ridge*†	14,588	C	14
Riverton		C	5
Roanoke		H	3
Robeline	183	D	2
Robert		A	13
Rocky Branch		B	5
Rocky Mount		A	2
Rodessa	307	A	1
Rogers		D	6
Roosevelt		B	7
Rosedale	753	G	6
Roselield		D	5
Roseland	1,162	G	8
Rosepine	1,390	F	2
Roy		C	3
Ruby		E	5
Ruston°	20,546	B	4
Sadie		A	5
St. Bernard		D	15
St. Francisville°	1,712	F	6
St. Gabriel	5,514	B	10
St. James		C	11
St. Joseph°	1,340	D	7
St. Landry		F	5
St. Martinville°	6,989	H	5
St. Maurice		D	3
St. Rose†	6,540	C	13
St. Tammany		A	15
Saline	296	C	3
Samtown		E	4
Sarepta	925	A	2
Schriever†	5,880	E	11
Scott	7,870	H	5
Searcy		D	5
Selma		D	4
Shamrock		D	2
Sharon		A	4
Shaw		E	6
Shelburn		A	7
Sheltons		A	5
Shenanduah*†	17,070	A	10
Sheridan		F	9
Shongaloo	162	A	2
Shreveport°	200,145	B	1
Sibley	1,098	B	2
Sicard		B	5
Sicily Island	453	D	6
Sieper		E	3
Sikes	120	C	4
Simmesport	2,239	F	6
Simpson	583	E	3
Simsboro	684	B	4
Singer		G	2
Slagle		E	3
Slaughter	1,011	G	7
Slidell	25,695	H	10
Somerset		C	7
Sondheimer		B	7
Sorrento	1,227	B	11
South Mansfield	352	C	1
South Vacherie*†	3,543	C	11
Spearsville	155	A	4
Spencer		A	5
Spillman		F	7
Spokane		D	6
Spring Ridge		B	1
Springfield	395	A	12
Springhill	5,439	A	2
Springville		A	11
Standard		D	5
Stanley	145	C	1
Starks		H	1
Start		B	5
State Line		F	10
Sterlington*	1,276	B	5
Stonewall	1,668	C	1
Sugartown		F	3
Sulphur	20,512	H	2
Summerfield		A	3
Summerville		D	5
Sun	471	G	10
Sunset	2,352	G	5
Supreme†	1,119	D	10
Swampers		C	6
Swartz†	4,247	B	5
Sykes Ferry		A	2
Taft†		C	12
Talisheek		A	15
Talla Bena		B	7
Tallulah°	9,189	B	7
Tangipahoa	747	F	8
Tannehill		C	4
Taylor		B	3
Taylortown		B	2
Tendal		B	7
Terry		A	7
Terrytown*†	25,430	D	14
Theriot		J	8
Thibodaux°	14,431	I	8
Thomastown		B	7
Tickfaw	617	G	8
Timberlane*†	11,405	D	14
Tioga		E	4
Toomey		H	1
Toro		E	2
Torras		F	6
Transylvania		B	7
Trees		A	1
Trinity		D	6
Triumph		J	11
Trout		D	4
Truxno		A	8
Tullos	419	D	4
Tunica		F	6
Tunica-Biluxi Indian Reservation	89	F	6
Turkey Creek	356	F	4
Union		C	11
Union Hill		F	3
Unionville		B	4
Urania	700	D	5
Vacherie		C	11
Varnado	342	F	10
Venice		J	11
Verda		D	3
Vernon		B	4
Vick		E	5
Vidalia°	4,543	D	6
Vienna	424	B	4
Village St. George*†	6,993	B	9
Ville Platte°	8,145	G	4
Vinton	3,338	H	2
Violet†	8,555	A	1
Vivian	4,031	A	1
Vixen		C	5
Waggaman*†	9,435	A	1
Wakefield		F	7
Waldheim		G	9
Walker	4,801	A	11
Walker		C	4
Wallace†	570	C	12
Wallace Ridge		D	6
Walters		D	5
Warden		B	6
Wardview		A	2
Wardville		A	5
Wardville		E	4
Warnerton		F	9
Washington	1,082	G	5
Waterproof	834	D	6
Waverly		B	6
Weeks		I	5
Weldon		A	4
Welsh	3,380	H	3
West Ferriday*†	1,541	D	6
West Monroe	13,250	B	5
Westdale		C	2
Westlake	4,668	H	2
Westminster*†	2,515	A	10
Weston		C	4
Westwego	10,763	D	14
Westwood		C	7
Weyanoke		F	6
Wheeling		D	3
White Castle	1,946	B	9
Whitehall		B	11
Whitehall		D	5
Wildsville		D	6
Williana		D	4
Willow Glen		E	4
Wilmer		F	9
Wilson	668	F	7
Winnfield°	5,749	C	4
Winnsboro°	5,344	C	6
Wisner	1,140	C	6
Womack		C	4
Woodardville		C	2
Woodland		F	7
Woodworth	1,080	E	4
Wyatt		C	4
Youngsville	3,992	H	5
Yscloskey		D	16
Zachary	11,275	G	7
Zenoria		D	4
Zimmerman		E	4
Zwolle	1,783	D	2
Zylks		A	1

*Does not appear on map; key shows general location.
†Census designated place—unincorporated, but recognized as a significant settled community by the U.S. Census Bureau.



°Parish seat.
Places without population figures are unincorporated.
Source: 2000 census.

Neil Johnson



Shreveport, the third largest city in Louisiana, is one of the state's leading centers of industry and trade. Shreveport lies on the Red River in the northwestern corner of Louisiana.

Visitor's guide

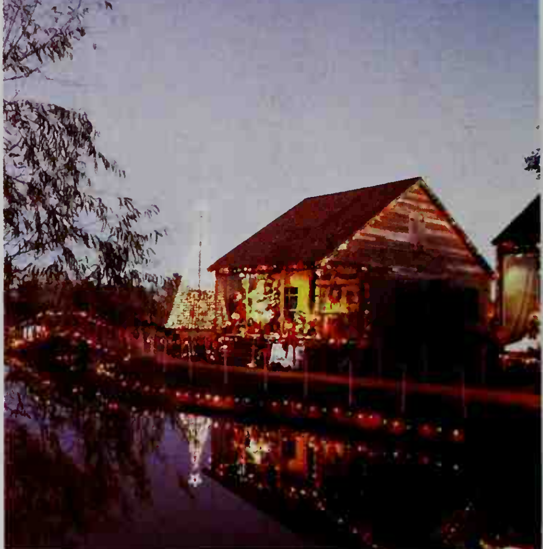
Millions of tourists visit Louisiana every year. New Orleans, with its famous French Quarter, or *Vieux Carré* (Old Square), is the chief tourist attraction. The state's many other attractions include Acadiana, the homeland of the Cajuns, and magnificent old plantation homes. Louisiana has abundant wildlife, rolling hills, and marshy lowlands to delight hunters and photographers. Fishing enthusiasts catch freshwater fish in lakes and rivers, and charter boats take them along the Gulf Coast in search of saltwater fish.

Visitors from all over the world come to New Orleans for its famous carnival season and Mardi Gras. The merrymaking begins on Twelfth Night—January 6—and includes many dances and parties throughout the following weeks. Colorful daily parades start about two weeks before Shrove Tuesday, the day before Lent begins. Many people in masks and showy costumes take part in these parades. Mardi Gras, held on Shrove Tuesday, climaxes the carnival season. The Mardi Gras celebration features grand parades of beautiful floats and marching bands, followed by several fancy-dress balls. See **Mardi Gras**.



Jackson Hill, Southern Lights

Egret Sanctuary on Avery Island



Sydney Byrd

Acadian Village in Lafayette

Places to visit

Following are brief descriptions of some of Louisiana's most interesting places to visit:

Acadiana, a region in the south-central part of the state, is known for the Cajuns and their unique food, music, and dialect. Acadiana was made famous by Henry Wadsworth Longfellow's poem *Evangeline.* The Longfellow-Evangeline State Commemorative Area includes the Acadian House Museum. Vermilionville in Lafayette features Cajun cultural events, architecture, and food.

Avery Island, which lies among sea marshes and swampy thickets near New Iberia, marks the top of a huge underground salt dome. Plants from all parts of the world can be seen in the island's Jungle Gardens, which also contain an egret sanctuary. *Tabasco,* a famous hot pepper sauce, is made on the island.

Feliciana Country includes the parishes of East and West Feliciana. John J. Audubon, the famous naturalist and painter of birds, made many sketches among the wooded hills of the region. The area has many old plantation homes.

Grand Isle lies south of New Orleans at the entrance to Barataria Bay. A few descendants of the pirate crew of Jean Laffite (also spelled *Lafitte*) live in the village on this island (see **Laffite, Jean**). Grand Isle is a fishing center.

Jean Lafitte National Historical Park and Preserve includes an area where part of the Battle of New Orleans was fought during the War of 1812. The park also includes the Cajun Cultural Center and a service that offers tours of the French Quarter of New Orleans.

Natchitoches is the oldest town in the Louisiana Territory. A French soldier established it along the banks of the Red River in 1714. The area still has much of its early French character.

New Orleans, famous for its Old World charm, is often called *America's Most Interesting City.* Its chief attractions include the old French and Spanish sections, fine restaurants, varied architecture, the Aquarium of the Americas, and Mardi Gras. See **New Orleans**.

Shreveport, in northwestern Louisiana, is the site of many interesting attractions. These attractions include the gardens of the American Rose Society, the Louisiana Downs thoroughbred racetrack, and museums. See **Shreveport**.

National monument and national forest. Poverty Point National Monument, at the Poverty Point State Commemorative area near Epps, has ancient earth dwellings. Kisatchie National Forest is located in the central part of the state. It is primarily a conservation area, and has facilities for boating, camping, fishing, and swimming.

State parks. Louisiana has 26 state parks and state commemorative areas. For information on these areas, write to the Office of State Parks, P.O. Box 44426, Baton Rouge, LA 70804-4426.

Annual events

January-March
Sugar Bowl Football Game in New Orleans (January); Mardi Gras in New Orleans and many other cities (before Shrove Tuesday); Louisiana Black Heritage festival in New Orleans (March); Taste of the Bayou Food Festival in Houma (March); Audubon Pilgrimage in St. Francisville (March).

April-June
Ponchatoula Strawberry Festival (April); Holiday in Dixie in Shreveport (April); Festival International de Louisiane in Lafayette (April); Jazz and Heritage Festival in New Orleans (April-May); Contraband Days in Lake Charles (May); Tomato Festival in Chalmette (May); Louisiana Peach Festival in Ruston (June); Bayou Lacombe Crab Festival (June); World Champion Pirogue Races in Lafitte (June).

July-September
Tarpon Rodeo in Grand Isle (July); Bayou Lafourche Antiques Show and Sale in Thibodaux (September); Louisiana Shrimp and Petroleum Festival in Morgan City (September); Festivals Acadiens in Lafayette (September); Frog Festival in Rayne (September).

October-December
French Food Festival in Larose (October); International Rice Festival in Crowley (October); Louisiana State Fair in Shreveport (October); Hodges Garden Fall Festival in Many (October); Bridge City Gumbo Festival (October); Gueydon Duck Festival (November); Natchitoches Christmas Festival of Lights (December); Bonfires on the Mississippi River Levee (Christmas Eve).



Mardi Gras parade in New Orleans


Dave Maenza, Stock Photo/Chicago



D. Donne Bryant

International Rice Festival in Crowley



D. Donne Bryant

Jazz band in Preservation Hall in New Orleans

Most of Louisiana was once part of an ancient bay of the Gulf of Mexico. The Mississippi and other rivers flowing from the north brought huge amounts of *silt* (particles of earth) to the bay. This action over thousands of years built up the land area to its present size.

Land regions. Louisiana has three main land regions. All are part of the fertile lowland that lies along the Gulf Coast of the United States. These regions are (1) the East Gulf Coastal Plain, (2) the Mississippi Alluvial Plain, and (3) the West Gulf Coastal Plain.

The East Gulf Coastal Plain in Louisiana covers the area east of the Mississippi River and north of Lake Pontchartrain. It rises gradually from marshes in the west and south to low, rolling hills in the north. The British and the Spanish once claimed most of this region as part of the territory of West Florida. The parishes in the area are still called the *Florida parishes.*

The Mississippi Alluvial Plain lies along the lower Mississippi River. In Louisiana, it reaches from the Arkansas state line to the Gulf of Mexico. Broad, low ridges and hollows parallel the river as it winds down the plain. Louisianians call the high fields atop the ridges *frontlands.* The frontlands slope away from the river to *backlands,* which are great stretches of clay and silt. The backlands have several ancient channels of the Mississippi, far from its present course.

The Mississippi Delta was formed of silt brought to the river's mouth. It covers about 13,000 square miles (33,700 square kilometers)—about a fourth of Louisiana's total area. The delta has the state's most fertile soil.

The West Gulf Coastal Plain includes all Louisiana west of the Mississippi Alluvial Plain. At the southern end of the plain, low sand ridges called *barrier beaches* lie along the Gulf of Mexico. Behind these beaches, marshes stretch inland for about 20 miles (32 kilometers). Beneath the marshes and the coastal and offshore waters are large underground formations called *salt domes.* These domes cap great deposits of salt. Pools of natural gas and petroleum are trapped along the sides of the salt deposits. Sulfur is sometimes found in the top of the domes between the salt and the upper crust.

North of the marshlands, the gently rolling Louisiana prairies—about 60 miles (100 kilometers) wide—reach westward across the plain to Texas. North of the prairies, the land rises gradually as it stretches toward Arkansas. The highest point in Louisiana is 535-foot (163-meter) Driskill Mountain, about 40 miles (64 kilometers) from the Arkansas line.

Coastline. Louisiana has a general coastline of 397 miles (639 kilometers) along the Gulf. But the marshy coast has been made extremely uneven by silt deposits. As a result, Louisiana's tidal shoreline—including bays, offshore islands, and river mouths—is 7,721 miles (12,426 kilometers) long. Among the states, only Alaska and Florida have longer tidal shorelines.

Salt water from the Gulf of Mexico enters the coastal waters through canals. It kills many of the freshwater marsh plants that help hold coastal soils in place. Large amounts of these soils wash away. About 50 square miles (130 square kilometers) of Louisiana's coastal land erodes annually.

Rivers, bayous, and lakes. The waters of all the rivers in Louisiana find their way to the Gulf of Mexico. The Mississippi, of course, is Louisiana's most important river (see **Mississippi River**). Other important rivers in the state include the Atchafalaya, Black, Calcasieu, Ouachita, Pearl, Red, and Sabine.

The silt carried by Louisiana's rivers has raised the riverbeds. This action has made the Mississippi and other rivers higher than the nearby backlands. As a result, water from major floods on the Mississippi could cover about a third of Louisiana. The chief natural drains of overflow water are the *bayous* (slow-moving inlets or outlets of lakes and rivers). Louisiana has many bayous, especially in the Mississippi Delta. See **Bayou.**

Since colonial times, people have built walls called *levees* along Louisiana's rivers to help control the floodwaters. Levees now stretch along about 1,650 miles (2,660 kilometers) of the rivers. The Bonnet Carré Spillway on the Mississippi and floodways built along the Atchafalaya River provide further flood control. They can

Land regions of Louisiana



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White Lake	E	3



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be opened to carry off high water when it threatens to flow over the levees. See **Levee**.

Louisiana has about 3,400 square miles (8,810 square kilometers) of inland water. The largest lake, Lake Pontchartrain, is a 625-square-mile (1,619-square-kilometer) *brackish* (part saltwater) lake. There are many saltwater lakes. These were once extensions of the sea that became cut off by ridges of sand or deposits of silt. Louisiana's many freshwater lakes include *oxbow lakes*. These crescent-shaped lakes, also known as *cutoff meanders*, used to be curves of rivers that became cut off from the main streams. Many of them lie along the western side of the Mississippi River north of Baton Rouge.

Plant and animal life. Forests cover about half of Louisiana. The trees include cypresses, magnolias, oaks, longleaf pines, and shortleaf pines. Spanish moss hangs from cypress and oak trees. Azaleas, camellias, honeysuckle, jasmine, lilies, and orchids grow in the state.

Wildlife thrives in Louisiana. Rabbits are plentiful and the northwestern hills have many gray foxes and beavers. White-tailed deer and wildcats roam wooded swamps. Minks, muskrats, opossums, raccoons, skunks, and wild hogs live in many wooded lowlands. Many alligators and beaverlike rodents called *nutrias* live in the coastal bayous and marshes. Louisiana has about 900,000 acres (364,200 hectares) of wildlife-refuge areas.

Birds include doves, egrets, herons, quails, and wild turkeys. The brown pelican, Louisiana's state bird, lives in the coastal marshes, where almost half the wild ducks and geese in North America spend the winter.



C. C. Lockwood

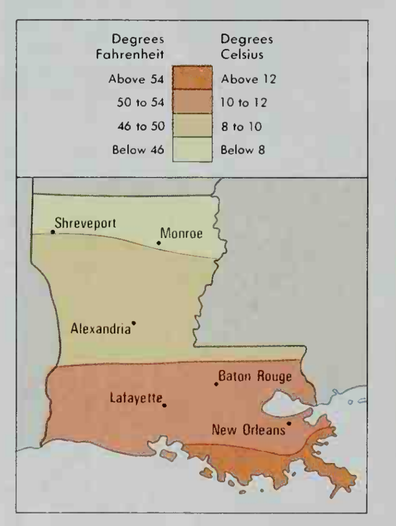
The Mississippi Delta was formed by silt carried down to the river's mouth. The delta covers about 13,000 square miles (33,700 square kilometers)—about a fourth of Louisiana's area.

Average monthly weather

	New Orleans					Shreveport				
	Temperatures F°		Temperatures C°		Days of rain or snow	Temperatures F°		Temperatures C°		Days of rain or snow
	High	Low	High	Low		High	Low	High	Low	
Jan.	64	48	18	9	10	56	40	13	4	10
Feb.	67	50	19	10	9	60	43	16	6	7
Mar.	71	55	22	13	9	68	49	20	9	9
Apr.	78	62	26	17	7	77	57	25	14	10
May	84	68	29	20	9	83	64	28	18	9
June	89	74	32	23	13	91	71	33	22	6
July	90	76	32	24	15	93	74	34	23	7
Aug.	91	76	33	24	14	95	74	35	23	7
Sept.	87	73	31	23	10	89	69	32	21	4
Oct.	80	65	27	18	6	80	57	27	14	5
Nov.	70	55	21	13	8	66	47	19	8	9
Dec.	65	50	28	10	10	58	41	14	5	7

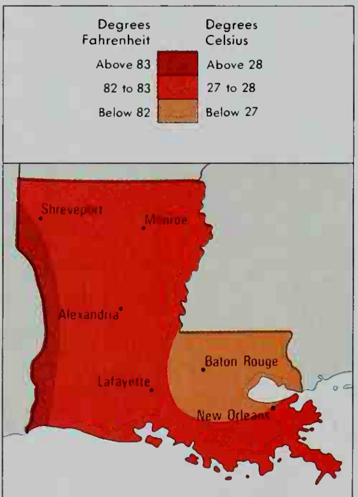
Average January temperatures

Louisiana has mild winters. The southeastern area is the warmest. Temperatures decline steadily to the north.



Average July temperatures

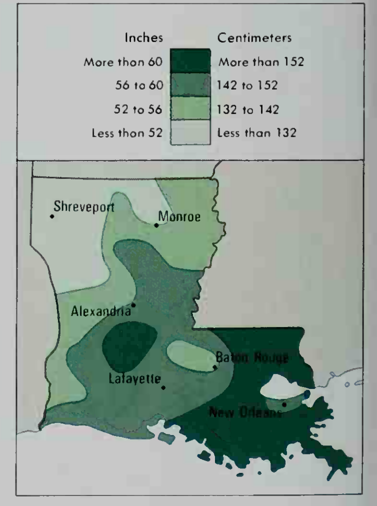
Most of Louisiana has a hot, humid, subtropical climate with very little variation in temperature during the summertime.



Average yearly precipitation

Louisiana is one of the wettest states. The heaviest rains fall in the southeastern part of the state, along the Gulf of Mexico.

WORLD BOOK maps



Louisiana's freshwater fish include bass, catfish, gaspergou (also called freshwater drumfish), and sunfish. Giant rays, menhaden, pompanos, and tarpons are found in the Gulf of Mexico. Great numbers of blue crab, oysters, and shrimp thrive along the coast.

Climate. Most of Louisiana has a hot, humid, subtropical climate. It is one of the wettest states, with a yearly average of 57 inches (145 centimeters) of precipitation. Southern Louisiana has an average January temperature of 55 °F (13 °C), and a July average of 82 °F (28 °C). The northern part of the state has an average January reading of 49 °F (9 °C), and a July average of 82.5 °F (28 °C). Louisiana's lowest recorded temperature, -16 °F (-27 °C), was at Minden on Feb. 13, 1899. The highest temperature on record was 114 °F (46 °C), at Plain Dealing on Aug. 10, 1936.

Hurricanes sometimes strike the coastal areas of Louisiana, causing loss of life and property. Since 1875, about 30 hurricanes and 55 lesser tropical storms have struck. About half the hurricanes occur in September.

Economy

From retail trade to real estate, service industries are the fastest growing sector of Louisiana's economy. As a group, they are the state's leading employer. Manufacturing and mining are also important economic activities in the state. Louisiana ranks high among the states in value of annual mineral production. It is one of the leading states in the production of petroleum and natural gas. Tourism supports many of Louisiana's industries, especially in the New Orleans area.

Natural resources of Louisiana include fertile soils, plentiful deposits of oil and gas, and thick forests.

Soil. Rich *alluvial soil* (soil deposited by rivers) covers about a third of Louisiana. Silt from the Mississippi River forms a rich, dark soil. The Red River deposits reddish-brown soil along its banks. Peat and muck soils are found in coastal marshes. The prairies in southwestern Louisiana have clay and clay loam.

Minerals. Louisiana is a leader among the states in known reserves of natural gas and petroleum. Many of these reserves lie in a narrow belt across southern Louisiana, part of an underground region called the *Tuscaloosa Trend.* This region also extends beneath portions of Texas, Mississippi, and the Gulf of Mexico. Rich petroleum deposits lie under nearly every one of Louisiana's 64 parishes and extend into the gulf. The best-developed petroleum deposits are in southern Louisiana and the gulf. The state's largest gas fields are in the northern section, but many small fields lie in the southern section and under the gulf. The southern section also has huge deposits of salt and sulfur.

Forests cover about half the state. In New Orleans, the United States Forest Service operates one of the country's largest forest-experimentation stations. More than 150 kinds of trees grow in Louisiana, including baldcypresses, magnolias, oaks, and pines.

Service industries, taken together, account for the largest part of Louisiana's *gross state product*—the total value of all goods and services produced in a state in a year. Most service industries are concentrated in the state's metropolitan areas.

Community, business, and personal services form the leading service industry in Louisiana in terms of the gross state product. This industry group includes a variety of businesses, such as private health care, hotels, law firms, and repair shops. New Orleans attracts millions of tourists each year.

Wholesale and retail trade ranks second among the state's service industries. The wholesale trade of automobiles, groceries, and petroleum products is especially important in Louisiana. Important types of retail establishments include discount stores, food stores, and restaurants. New Orleans is the state's primary center of wholesale and retail trade.

Finance, insurance, and real estate forms the next most important service industry in Louisiana in terms of the gross state product. New Orleans is the center of this industry. Bank One, Louisiana, a subsidiary of the Bank One Corporation, is the state's largest banking company. The state's financial companies receive much income from petroleum and gas companies.

Government ranks fourth among Louisiana's service industries. Government services include public schools and hospitals and military activities. State government offices are based in Baton Rouge, the state capital.

Transportation, communication, and utilities ranks fifth among Louisiana's service industries. Water transportation is of great importance in the state. New Orleans and Baton Rouge are two of the nation's busiest ports. Many large shipping firms are based in these cities. Companies that operate oil and gas pipelines are also part of the transportation industry in Louisiana. More information about transportation and communication appears later in this section.

Manufacturing. Goods made in Louisiana have a *value added by manufacture* of about $31 billion. This figure represents the increase in value of raw materials after they become finished products. Louisiana has more

Production and workers by economic activities

Economic activities	Percent of GSP* produced	Employed workers: Number of people	Employed workers: Percent of total
Community, business, & personal services	17	687,800	29
Manufacturing	15	198,800	8
Wholesale & retail trade	14	505,300	21
Mining	14	66,200	3
Finance, insurance, & real estate	13	135,500	6
Government	12	402,000	17
Transportation, communication, & utilities	8	130,700	6
Construction	4	167,800	7
Agriculture	1	67,800	3
Total	100	2,361,900	100

*GSP = gross state product, the total value of goods and services produced in a year.
Figures are for 1998.
Sources: *World Book* estimates based on data from U.S. Bureau of Economic Analysis and U.S. Bureau of Labor Statistics.

than 3,500 manufacturing firms.

The production of chemicals is, by far, Louisiana's leading manufacturing activity in terms of value added by manufacture. Baton Rouge, Lake Charles, New Orleans, and Shreveport are the chief production centers. The state's chemical products include drugs, fertilizers, paint, *petrochemicals* (chemicals made from petroleum), plastics, and soap.

The processing of petroleum and coal products is Louisiana's second-ranking manufacturing activity. Petroleum refineries provide nearly all of the income for this industry. Almost all of Louisiana's petroleum refineries are located in the southern part of the state.

The production of transportation equipment is the third most valuable manufacturing activity in Louisiana in terms of value added by manufacture. Shipbuilding is the most prominent industry. Factories in Louisiana also produce aircraft, automobile and truck parts, missile parts, and truck trailers.

Paper products rank fourth among Louisiana's manufactured products. Paper and pulp mills are found statewide. Northern Louisiana has several plants that produce corrugated boxes, cardboard tubes, food containers, and other paper products.

Food processing ranks fifth among Louisiana's manufacturing activities. The state's leading processed foods are coffee, soft drinks, and sugar. Plants in New Orleans process coffee beans imported from Latin America. Soft drink bottlers operate in most of the state's major cities. Southeastern Louisiana has many sugar refineries. The state's other food products include baked goods, hot sauces, condiments, milled rice, and pasteurized milk.

Louisiana's other manufactures include clothing, electrical equipment, fabricated metal products, machinery, plastics and rubber products, and wood products.

Mining. Louisiana's chief mined products are petroleum and natural gas. The petroleum industry operates about 19,500 oil wells, mainly in the southern marshlands and the Shreveport area. Many offshore oil wells have been drilled in the Gulf of Mexico from platforms resting on tall supports and from floating rigs. The largest natural gas fields lie near Monroe and Shreveport. But there are also many gas wells in southern Louisiana and offshore gas wells in the gulf. Onshore wells produce most of Louisiana's petroleum and natural gas. Petroleum and natural gas account for more than 95 percent of the state's mining income.

Among Louisiana's other mined products, sulfur and salt are most important. Most of the state's sulfur comes from an offshore mine. Because of the mine's location offshore, tax income from the mine is collected not by the state, but by the federal government. Most of the salt mines are in the coastal marshes. Louisiana also produces coal, and sand and gravel.

Agriculture. Farmland covers about a third of Louisiana's land area. Louisiana has approximately 30,000 farms. Crops account for nearly two-thirds of Louisiana's farm income. Cotton is the leading farm product in the state. Most of Louisiana's cotton is grown in the northeastern part of the state.

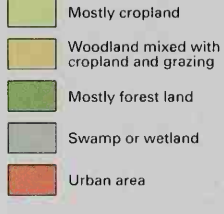
Other important crops grown in Louisiana include rice, sugar cane, and soybeans. Many rice farms lie between Lake Charles and Lafayette. Farmers grow sugar cane mainly in the areas south of Baton Rouge and Lafayette. Soybeans are used mainly for making livestock feed and soybean oil. Large numbers of soybean farms lie in a region that runs from the northeast corner of the state south to Lake Charles.

Sweet potatoes and tomatoes are the most valuable vegetable crops. Peaches, strawberries, and melons are the most valuable fruit crops.

The raising of *broilers* (chickens from 5 to 12 weeks old) provides the largest portion of the livestock farming income in Louisiana. The raising of beef and dairy cattle is also important. Nearly all areas of the state have farmers who raise beef cattle. Many dairy farms lie north of Lake Pontchartrain. Louisiana farms also produce eggs and hogs. Commercial fish farms in the state produce

Economy of Louisiana

This map shows the economic uses of land in Louisiana and where the state's leading farm, mineral, and forest products are produced. The major urban areas (shown on the map in red) are the state's important manufacturing centers.





WORLD BOOK map



Jackson Hill, Southern Lights

Salt mining is an important Louisiana mining activity. Louisiana leads the states in the production of salt and is one of the leading states in the total annual value of mineral production.

catfish and crayfish. Some farmers raise fur-bearing animals for pelts. Hunters trap animals in the wild for fur.

Fishing industry. Louisiana ranks among the leading states in commercial fishing. Its annual fish catch is valued at about $300 million. Shrimp is the most important product of the state's fishing industry. Louisiana is the leading state in shrimp production. Other important products include catfish, crayfish, menhaden, and oysters. The state's main fishing ports are Cameron, Chauvin, Delcambre, Dulac, Empire-Venice, Golden Meadow-Leeville, Grand Isle, and Lafitte.

Electric power. Plants that burn natural gas provide about 45 percent of Louisiana's electric power. Coal-burning plants produce about 30 percent. Nuclear plants provide most of the rest.

Transportation. The Mississippi and other rivers of Louisiana have been both an aid and a barrier to transportation in the state. During the early years, riverboats provided the chief means for moving people and products. But the rivers were also major obstacles to the construction of highways and railroads.

To solve this problem, the state increased the number of bridges over the smaller rivers during the 1930's. But until 1935, ferryboats were Louisiana's only means of getting automobiles and trains across the wide Mississippi. The Huey P. Long Bridge, which opened in 1935 near New Orleans, was the first bridge entirely within the state to cross the Mississippi. Today, bridges also cross the river at Baton Rouge, Delta, Donaldsonville, Gramercy, Luling, Mound, and Vidalia. The state opened the world's longest bridge, the Lake Pontchartrain Causeway, in 1956. The bridge has a total length of about 29 miles (47 kilometers). It crosses 24 miles (39 kilometers) of water, and connects New Orleans with St. Tammany Parish to the north. Twin bridges called the Crescent City Connection link the heart of New Orleans with the Mississippi's west bank. One carries westbound traffic, and the other, eastbound traffic. Each has a main span of 1,575 feet (480 meters), among the longest spans of all the cantilever bridges in the world.

New Orleans International Airport, in Kenner, is the state's busiest airport. It handles both domestic and international flights. There are small airports and private airstrips in most parts of the state. The Pontchartrain Railroad was the first railroad west of the Allegheny Mountains. It began operating in 1829, between New Orleans and Lake Pontchartrain. Today, about 20 freight railroads operate in Louisiana. Passenger trains serve 10 cities.

Louisiana has about 60,000 miles (96,000 kilometers) of roads and highways. Two east-west interstate highways cross the state, and three north-south.

Most of Louisiana's port activities take place near New Orleans, Baton Rouge, and Lake Charles. Based on total tonnage, the Port of South Louisiana, at Laplace, handles more cargo than any other United States port. Baton Rouge is the most inland deepwater port on the Mississippi River. It lies about 235 miles (380 kilometers) from the Gulf of Mexico, but oceangoing ships can travel up the river and dock.

Louisiana has about 5,000 miles (8,000 kilometers) of navigable rivers and other waterways. The Mississippi River-Gulf Outlet, a canal 76 miles (122 kilometers) long, provides a direct route between New Orleans and the Gulf of Mexico. The Gulf Intracoastal Waterway provides a sheltered east-west route across the coastal marshes.

Communication. The first newspaper in Louisiana was established at New Orleans in 1794 by Louis Duclot. This French-language journal, *Le Moniteur de la Louisiane (The Louisiana Monitor),* was the only newspaper in the region until 1803. That year, Louisiana's first English-language newspaper, the *New Orleans Union,* was started. Louisiana has about 20 daily newspapers and over 90 weeklies. *The Times-Picayune* of New Orleans leads in circulation. Other papers in the state include *The* (Shreveport) *Times* and *The* (Baton Rouge) *Advocate.*

Louisiana's first radio stations, WWL in New Orleans and KEEL in Shreveport, started broadcasting in 1922. The first television station, WDSU-TV in New Orleans, was started in 1948. The state has about 180 radio stations and 30 television stations. Cable television systems and Internet providers service communities statewide.

Government

Constitution. The present Constitution of Louisiana —the 11th in the state's history—was adopted in 1974. It replaced a constitution that had been *amended* (changed) more than 535 times. The old Constitution, which had been adopted in 1921, included more than 250,000 words and ranked as the longest state constitution. The 1974 Constitution has about 35,000 words.

An amendment to the Constitution may be proposed by the Legislature or by a constitutional convention. The Legislature, by a two-thirds vote of each house, may call a constitutional convention. An amendment proposed in the state Senate or House of Representatives must be

The governors of Louisiana

	Party	Term		Party	Term
W. C. C. Claiborne	*Jeff. Rep.	1812-1816	**Francis T. Nicholls**	Democratic	1888-1892
Jacques Villeré	*Jeff. Rep.	1816-1820	**Murphy J. Foster**	Democratic	1892-1900
Thomas B. Robertson	*Jeff. Rep.	1820-1824	**William W. Heard**	Democratic	1900-1904
Henry S. Thibodaux	*Jeff. Rep.	1824	**Newton C. Blanchard**	Democratic	1904-1908
Henry Johnson	*Jeff. Rep.	1824-1828	**Jared Y. Sanders**	Democratic	1908-1912
Pierre Derbigny	*Jeff. Rep.	1828-1829	**Luther E. Hall**	Democratic	1912-1916
Armand Beauvais	*Jeff. Rep.	1829-1830	**Ruffin G. Pleasant**	Democratic	1916-1920
Jacques Dupré	*Jeff. Rep.	1830-1831	**John M. Parker**	Democratic	1920-1924
Andre B. Roman	Whig	1831-1835	**Henry L. Fuqua**	Democratic	1924-1926
Edward D. White	Whig	1835-1839	**Oramel H. Simpson**	Democratic	1926-1928
Andre B. Roman	Whig	1839-1843	**Huey P. Long**	Democratic	1928-1932
Alexandre Mouton	Democratic	1843-1846	**Alvin O. King**	Democratic	1932
Isaac Johnson	Democratic	1846-1850	**Oscar K. Allen**	Democratic	1932-1936
Joseph Walker	Democratic	1850-1853	**James A. Noe**	Democratic	1936
Paul O. Hebert	Democratic	1853-1856	**Richard W. Leche**	Democratic	1936-1939
Robert C. Wickliffe	Democratic	1856-1860	**Earl K. Long**	Democratic	1939-1940
Thomas O. Moore	Democratic	1860-1864	**Sam H. Jones**	Democratic	1940-1944
Federal Military Rule		1862-1864	**Jimmie H. Davis**	Democratic	1944-1948
Henry W. Allen	Democratic	1864-1865	**Earl K. Long**	Democratic	1948-1952
Michael Hahn	Republican	1864-1865	**Robert F. Kennon**	Democratic	1952-1956
James M. Wells	Republican	1865-1867	**Earl K. Long**	Democratic	1956-1960
Benjamin Flanders	Republican	1867-1868	**Jimmie H. Davis**	Democratic	1960-1964
Joshua Baker	Republican	1868	**John J. McKeithen**	Democratic	1964-1972
Henry C. Warmoth	Republican	1868-1872	**Edwin W. Edwards**	Democratic	1972-1980
P. B. S. Pinchback	Republican	1872-1873	**David C. Treen**	Republican	1980-1984
John McEnery	Democratic	1873	**Edwin W. Edwards**	Democratic	1984-1988
William P. Kellogg	Republican	1873-1877	**Buddy Roemer**	Republican†	1988-1992
Francis T. Nicholls	Democratic	1877-1880	**Edwin W. Edwards**	Democratic	1992-1996
Louis A. Wiltz	Democratic	1880-1881	**Murphy J. (Mike) Foster, Jr.**	Republican	1996-
Samuel D. McEnery	Democratic	1881-1888			

*Jeffersonian Republican, sometimes called Democratic-Republican. †Elected as a Democrat in 1987; switched to Republican Party in 1991.

approved by two-thirds of both houses. An amendment proposed by the Legislature or a constitutional convention must be approved in a statewide election.

Executive. The governor serves a four-year term. The governor is limited to two terms in a row, but can serve an unlimited number of terms. The governor can veto any bill passed by the Legislature. The Legislature can override the veto by a two-thirds vote in each house.

The voters elect the governor and the other chief state officials to four-year terms. These officials are the lieutenant governor, secretary of state, attorney general, treasurer, commissioner of insurance, commissioner of elections, and commissioner of agriculture.

Legislature consists of a Senate of 39 members and a House of Representatives of 105 members. Louisiana has 39 senatorial districts and 105 representative districts. Voters in each senatorial district elect one senator. Voters in each representative district elect one representative. Senators and representatives serve four-year terms and may serve no more than three terms in a row in the same house. Both houses meet every year. Regular sessions in odd-numbered years begin on the last Monday in March and may run 60 legislative days. Regular sessions in even-numbered years begin on the last Monday in April and may run 30 legislative days. Special sessions may run only 30 days.

Courts. Louisiana is the only state in which judges do not decide cases chiefly on the basis of *common law.* Under the common-law system, rulings are determined by previous court decisions and the people's customs. Louisiana judges decide civil cases on the basis of a *code* (set of rules). The code is based largely on France's Napoleonic code. See **Code Napoléon; Common law.**

Louisiana's highest court is the Supreme Court, which hears both civil and criminal cases. The Supreme Court has a chief justice and six associate justices, all elected to 10-year terms. The associate justice with the longest service becomes the chief justice. The court system also includes 5 courts of appeal and 40 district courts.

Local government. Louisiana is the only state that calls its counties *parishes.* The parishes arose as administrative units of the Roman Catholic Church during



D. Donne Bryant

The Louisiana Legislature consists of a House of Representatives of 105 members and a Senate of 39 members. The House meets in chambers in the State Capitol in Baton Rouge, *above.*

Spanish rule of the area. Under the Constitution of 1845, Louisiana dropped its county organization, and the parishes took over the counties' functions. Louisiana now has 64 parishes. Most of them have a central governing body called the *police jury,* which resembles a county board of commissioners. The members of each police jury elect one of their number as president. Most police jurors and other parish officials are elected to four-year terms.

Louisiana has about 300 incorporated cities, towns, and villages. Almost all of them have a mayor-council form of government.

Revenue. Taxation provides about 45 percent of the state government's *general revenue* (income). Most of the rest of the revenue comes from federal grants and *royalties* (shares of profits) from mineral production. The most important taxes in Louisiana include a personal income tax, a motor fuel use tax, a severance tax on mineral production, and a tax on corporate profits.

Politics. The Democratic Party has controlled Louisiana politics throughout most of the state's history. The Republican Party began to gain strength in the state during the 1950's. For a discussion of this change, see *The mid-1900's* in the *History* section of this article.

Democratic candidates carried the state in all presidential elections from 1880 through 1944. Since then, Louisiana has given its electoral votes to Republican presidential candidates in half of the elections. For the state's electoral votes and voting record in presidential elections, see **Electoral College** (table).

In 1979, David C. Treen became the first Republican to be elected governor of the state since 1876, when federal control ended after the American Civil War. In 1972, Treen had become the first Republican to be elected to the U.S. House of Representatives from Louisiana since the late 1880's.

History

Indian days. When the first Europeans arrived, about 12,000 Indians lived in what is now Louisiana. They belonged to about 30 tribes, including the Atakapa, Caddo, Chitimacha, and Tunica. The Indians lived mainly in villages on the banks of rivers and bayous. They built huts of poles. They thatched the huts with leaves and sometimes plastered them with mud. The women worked in the fields, and the men hunted and fished.

Exploration and early settlement. In 1541, Hernando de Soto led a group of Spanish explorers into the lower Mississippi River area in a useless search for gold. The Spaniards made no further exploration of the lower area after De Soto died there in 1542.

In 1682, the French explorer René-Robert Cavelier, Sieur de La Salle, led about 50 Frenchmen and Indians into the lower Mississippi River area. They came down the Mississippi River from the Great Lakes region. On April 9, 1682, La Salle claimed the entire Mississippi Valley for France. He erected a cross and a column bearing the French coat of arms near the mouth of the Mississippi. La Salle named the region Louisiana, in honor of Louis XIV, the king of France.

Louisiana became a French *royal colony* (a colony controlled by a king) in 1699. Pierre Le Moyne, Sieur



Admiral Farragut's Fleet Passing New Orleans (1867), an oil painting on canvas by M. F. H. de Haas; Historic New Orleans Collection

Union forces captured New Orleans during the American Civil War on May 1, 1862. A naval squadron under Captain David G. Farragut fought through Confederate defenses and took the city. The North held New Orleans and southern Louisiana for the rest of the war.

d'Iberville, founded a French settlement at what is now Ocean Springs, Miss. This settlement at Ocean Springs was the capital of Louisiana until 1702. That year, the capital was moved to Fort Louis de la Mobile, near the site of present-day Mobile, Ala. Iberville was governor of the royal colony until his death in 1706, though he was absent from Louisiana after 1702 while fighting in the War of Spanish Succession.

In 1712, France gave exclusive trading rights in Louisiana to Antoine Crozat, a merchant. This transfer of control made the area a *proprietary colony.* Louis Juchereau de St. Denis, a trader, established Natchitoches on the banks of the Red River in 1714. This settlement became the first permanent town in Louisiana. In 1717, Crozat's trading rights were transferred to John Law, a Scottish financial promoter in Paris. Law started an investment scheme to colonize Louisiana.

In 1718, the governor of Louisiana began building New Orleans. He was Jean Baptiste le Moyne, Sieur de Bienville, a brother of Iberville. New Orleans became the capital in 1722.

Spanish rule. John Law's scheme to colonize Louisiana finally failed in 1720. Louisiana again became a royal colony of France in 1731. But the French were disappointed with the small income produced in the colony. In 1762, France secretly ceded to Spain the *Isle of Orleans,* which included New Orleans, and the area of Louisiana west of the Mississippi River. French colonists learned of the transfer in 1764 and became angry. In 1768, a band of Frenchmen drove out the Spanish governor. But Spain took firm control of its new possession in 1769.

Between the 1760's and 1790, about 4,000 French settlers from Canada arrived in Louisiana. British troops had driven them from their homes in Acadia, in eastern Canada. The Acadians settled chiefly along the Teche, Lafourche, and Vermilion bayous. Their descendants came to be known as *Cajuns.* See **Acadia.**

During the Revolutionary War in America (1775-1783), Spain allowed agents of the Continental Congress to use New Orleans as a base. These agents shipped supplies up the Mississippi and Ohio rivers to the struggling American Colonies.

Louisiana prospered under Spanish rule. The government was stable, and encouraged business and commerce. The Louisiana sugar industry began in 1795, when Étienne de Boré developed a method of processing sugar on a large scale. Louisiana planters began growing sugar cane as a major crop. In 1800, France secretly persuaded Spain to return Louisiana to France. However, Spain kept the region until November 1803.

Territorial days. France sold Louisiana, which included the Mississippi Valley region, to the United States for about $15 million. The United States took possession on Dec. 20, 1803. See **Louisiana Purchase.**

In 1804, Congress divided the huge territory to make it easier to govern. One part became the Territory of Orleans. It covered about the same area as the present state of Louisiana. William C. C. Claiborne became the first and, as it developed, the only governor of the territory. The other part, beyond the present northern boundary of the state, became the District of Louisiana. This area became the Territory of Louisiana in 1805. In 1812, it was renamed the Territory of Missouri.

A period of commercial expansion began in 1812, when the steamboat *New Orleans* completed the first trip down the Ohio and Mississippi rivers from Pittsburgh, Pa. The Mississippi River soon became the chief shipping waterway of the inland United States.

In September 1810, American settlers in the Spanish possession of West Florida revolted against Spain. They organized the Republic of West Florida, which included part of what is now eastern Louisiana. United States troops occupied part of the republic in October 1810. President James Madison declared that the region belonged to the United States as part of the Louisiana Purchase.

Statehood. On April 30, 1812, the Territory of Orleans was renamed Louisiana, and became the 18th state of the Union. It had about 76,000 people. William C. C. Claiborne was the first governor of the state, and New Orleans was the first capital.

The War of 1812 (1812-1815) began soon after Louisiana became a state. In December 1814 and January 1815, the British tried to capture New Orleans. General Andrew Jackson and his little army of frontiersmen and pirates defeated the British. The final clash of the Battle of New Orleans took place on Jan. 8, 1815. Unknown to both sides, a treaty of peace had already been signed in Ghent, Belgium, two weeks earlier. See **Jackson, Andrew** (Glory at New Orleans).

Thousands of new settlers arrived in Louisiana between 1815 and 1860. Trade expanded during the 1830's after Henry M. Shreve, a steamboat builder and operator, cleared out the Red River for navigation. Alexandria, Natchitoches, and Shreveport (named for Shreve) became trade centers as river traffic developed.

The state capital was moved to Donaldsonville in 1830 but moved back to New Orleans the next year. The state legislature moved the capital to Baton Rouge in 1850, where it remained until 1862.

The Civil War and Reconstruction. On Jan. 26, 1861, Louisiana *seceded* (withdrew) from the Union and prepared for war. The state joined the Confederacy on March 21. The Civil War (1861-1865) did not touch Louisiana until 1862. That year, a Union naval squadron under David G. Farragut bombarded the Mississippi River forts guarding New Orleans. Union soldiers under General Benjamin F. Butler occupied the city on May 1, 1862, without a battle.

The Union forces maintained a capital in New Orleans throughout the war. The Confederate state government established its capital at Opelousas in 1862 and moved to Shreveport in 1863. Union troops gradually extended their control. There was little fighting, but great property destruction.

When the war ended, Louisiana was bankrupt. Only Georgia, South Carolina, and Virginia had suffered more casualties and destruction. Louisiana was readmitted to the Union on June 25, 1868. That year, Henry C. Warmoth took office as governor. He won an election under a new constitution that allowed blacks to vote and took away voting rights from some whites, including those who had held political office under the Confederacy for more than a year. The state government increased taxes to help pay for new public services. Louisiana's taxes had been relatively low before the Civil War, and so the higher taxes angered many people. A group from New

Historic Louisiana

Acadians from Nova Scotia settled in Louisiana between the 1760's and 1790's. Henry Wadsworth Longfellow described their journey in his poem *Evangeline.*







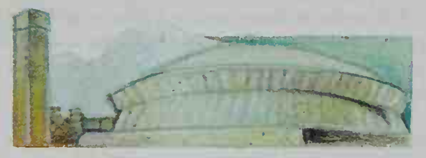
The Louisiana Purchase was signed in Paris on May 2, 1803, by James Monroe and Robert Livingston. The purchase, for about $15 million, almost doubled the size of the United States.



The steamboat *New Orleans* completed the first steam-powered trip down the Mississippi in 1812, from Pittsburgh to New Orleans. By 1846, nearly 1,200 steamboats traveled up and down the river on regular schedules.



Andrew Jackson and a small army of frontiersmen defeated the British in the Battle of New Orleans during the War of 1812.



The Louisiana Superdome, the world's largest indoor arena, opened in 1975. The Superdome can seat up to 95,427 people for festivals or conventions.

WORLD BOOK illustrations by Kevin Chadwick

Important dates in Louisiana

1541 Hernando de Soto led a Spanish expedition into the lower Mississippi River area.

1682 René-Robert Cavelier, Sieur de la Salle, reached the mouth of the Mississippi River and claimed the river valley for France.

1699 The royal French colony of Louisiana was founded.

1714 Louis Juchereau de St. Denis founded Natchitoches, the first permanent town in Louisiana.

1718 Jean Baptiste le Moyne, Sieur de Bienville, founded New Orleans.

1762 France ceded Louisiana to Spain.

1795 Étienne de Boré developed a large-scale method for granulating sugar.

1800 Spain ceded Louisiana back to France.

1803 The U.S. purchased Louisiana from France.

1812 Louisiana became the 18th state on April 30.

1815 Andrew Jackson defeated the British in the Battle of New Orleans.

1861 Louisiana seceded from the Union.

1862 Union troops captured New Orleans.

1868 Louisiana was readmitted to the Union.

1879 James B. Eads deepened the mouth of the Mississippi River so large ocean ships could reach New Orleans.

1901 Oil was discovered near Jennings and White Castle.

1916 The Monroe natural gas field was opened.

1928 Huey P. Long became governor.

1935 Long was assassinated.

1961 The National Aeronautics and Space Administration selected the Michoud Ordnance Plant (now Michoud Assembly Facility) in New Orleans to produce Saturn rocket boosters.

1963 The Mississippi River-Gulf Outlet, a short cut for shippers between New Orleans and the sea, opened.

1975 A new state constitution went into effect.

1979 David C. Treen became the first Republican to be elected governor of Louisiana since 1877.

1986 An amendment to the state constitution gave more than $1 million to the Louisiana Education Trust Fund.

Orleans tried unsuccessfully to seize control of the government in a battle on Sept. 14, 1874.

President Rutherford B. Hayes withdrew the federal troops from Louisiana in 1877, and ended Reconstruction there. The troops had remained in Louisiana later than in any other Southern state. During the next 10 years, Louisianians built new railroads and schools, and improved their waterways. Commerce revived after 1879, when engineers deepened the mouth of the Mississippi River. The dredging enabled large oceangoing ships to dock at New Orleans. The legislature adopted a new constitution in 1879. Baton Rouge replaced New Orleans as the capital in 1882.

Growth of commerce and industry. Railroads expanded rapidly in Louisiana as New Orleans increased in importance as a port. By 1883, New Orleans had rail connections with all the major cities in the United States. Foreign commerce in the city increased even more after the Panama Canal was completed in 1914.

The discovery of great mineral resources in the early 1900's led to industrial expansion and many local improvements. Oil was first discovered near Jennings and White Castle in 1901. In 1916, natural gas was found near Monroe. Great fields of natural gas, petroleum, and sulfur attracted many new industries. Trunkline railroads spread into every section of the state. Road builders began to lift Louisiana out of the mud of its dirt roads. Parishes improved their school buildings and educational programs.

A disastrous flood on the Mississippi River struck northern and south-central Louisiana in 1927. As a result, the federal government joined with Louisiana to start building vast flood-control projects.

Huey P. Long built a powerful political organization in Louisiana during the late 1920's. The people elected him governor in 1928. Long became practically a dictator, but his vigorous program of public works and social welfare helped develop the state. During Long's administration, Louisiana extended its highway and bridge systems, enlarged the state university, and built a new capitol in Baton Rouge. The state also began giving free textbooks to schoolchildren. Long was elected a U.S. senator in 1930. He was shot to death at the state Capitol in 1935. In 1939, the federal government convicted many leaders of the Long group for fraud and other crimes. A reform group took control of the state government in 1940. But the Long organization quickly revived and has remained a strong force in Louisiana.



Leon Trice, Publix

Governor Huey P. Long, *second from right,* and other officials celebrated adoption of the Mississippi Valley Flood Control Act in 1928. Long built a powerful organization in Louisiana.

The mid-1900's. During World War II (1939-1945), many new industries, including shipbuilding and petrochemical production, began in Louisiana. The oil and gas industries expanded rapidly, and shipping through the Port of New Orleans increased sharply. Louisiana industry continued to grow throughout the 1940's and 1950's, when the number of factories rose about 60 per cent. Thousands of Louisianians moved from rural areas to cities so they could work in the new factories.

Louisiana started to play a major role in the U.S. space program in 1961. That year, the National Aeronautics and Space Administration (NASA) selected the old Michoud Ordnance Plant in New Orleans to produce the Saturn rocket. This plant, renamed the Michoud Assembly Facility, produced its first rocket in 1963. Michoud's Saturn V rocket launched the Apollo 11 astronauts to the moon in 1969.

New Orleans helped increase its foreign trade by opening International House in 1944 and the International Trade Mart in 1948. These facilities provided information on world trade, and space for offices and trade exhibits. In 1963, the Mississippi River-Gulf Outlet opened. This 76-mile (122-kilometer) canal gave shippers a 44-mile (71-kilometer) short cut between New Orleans and the Gulf of Mexico. Also in 1963, workers completed a project to keep the Mississippi River from changing its course into the Atchafalaya River, away from New Orleans. The Army Corps of Engineers built a dam, floodway, and levees as part of this project.

Like many northern and southern states, Louisiana faced serious racial problems in the 1950's and 1960's. The graduate school at Louisiana State University in Baton Rouge became integrated in 1950. This action took place under an order by the United States Circuit Court of Appeals. In 1954, the Supreme Court of the United States ruled that compulsory segregation in public schools was unconstitutional. In Louisiana, the first black pupils entered all-white public elementary schools in 1960, in New Orleans. The state's libraries and restaurants also became integrated in the 1960's.

The Republican Party gained strength in Democratic Louisiana during the 1950's and 1960's. In 1956, Dwight D. Eisenhower became the first Republican to win Louisiana's electoral votes in a presidential election since 1876. In 1964, two Republicans became the first members of their party since the 1800's to be elected to the Louisiana House of Representatives.

In 1968, Ernest N. Dutch Morial of New Orleans became the first black since Reconstruction to win election to the Louisiana House of Representatives. In 1977, Morial was elected as the first black mayor of New Orle-

ans. In 1979, David C. Treen became the first Republican to be elected governor since the 1870's.

Recent developments. Louisiana continued to experience rapid industrial growth in the early 1980's. By the mid-1980's, however, Louisiana faced a severe economic decline. A drop in oil prices hurt the state's oil exploration and service industries, and many people in these industries were laid off. The state's unemployment rate became the highest in the nation.

Officials had to deal with other problems as well. For example, they faced the challenge of cleaning up toxic waste and pollution caused by the petrochemical industry. They also worked to prevent a large portion of coastal wetlands from being lost to erosion.

In September 1986, Louisiana voters approved a constitutional amendment that gave a portion of Louisiana's offshore oil revenues to the newly formed Louisiana Education Trust Fund. The fund received over $1 million to make needed improvements.

Today, agriculture remains important to the state's economy, but more Louisianians work in factories than on farms. More than two-thirds of the people live in urban areas.

In August 1992, Hurricane Andrew struck Louisiana. The hurricane killed 11 people and caused about $1 billion in damage. Much of the damage was caused by tornadoes that spun out of the hurricane. South-central Louisiana, including Lafayette and New Iberia, was the hardest-hit area in the state.

Harold A. Petersen and Timothy F. Reilly

Study aids

Related articles in *World Book* include:

Biographies

Armstrong, Louis
Audubon, John J.
Beauregard, Pierre G. T.
Bienville, Sieur de
Bontemps, Arna
Butler, Benjamin F.
Cable, George W.
Capote, Truman
Cliburn, Van
Fiske, Minnie M.
Hellman, Lillian
Laffite, Jean
La Salle, Sieur de
Law, John
Long (family)
Pinchback, P. B. S.
Polk, Leonidas
Richardson, Henry H.
Robinson, Eddie
Slidell, John
Taylor, Zachary
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Cities

Baton Rouge
Lake Charles
New Orleans
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History

Acadia
Cajuns
Civil War
Code Napoléon
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War of 1812

Physical features

Bayou
Gulf of Mexico
Lake Pontchartrain
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Outline

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A. Population
B. Schools
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II. Visitor's guide
A. Places to visit
B. Annual events

III. Land and climate
A. Land regions
B. Coastline
C. Rivers, bayous, and lakes
D. Plant and animal life
E. Climate

IV. Economy
A. Natural resources
B. Service industries
C. Manufacturing
D. Mining
E. Agriculture
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G. Electric power
H. Transportation
I. Communication

V. Government
A. Constitution
B. Executive
C. Legislature
D. Courts
E. Local government
F. Revenue
G. Politics

VI. History

Questions

How does the legal system of Louisiana differ from those of all the other states?
How were the many saltwater lakes in Louisiana formed?
What are counties called in Louisiana?
What is Louisiana's part in the U.S. space program?
Who are the *Cajuns* and the *Creoles*?
In what way is the Lake Pontchartrain Causeway notable?
How did Louisiana become a part of the United States?
What is the most popular event that is held annually in the state?
What was the Mississippi River's part in forming the richest farmlands of Louisiana?
What is the most important economic activity in Louisiana?

Additional resources

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Louisiana Purchase was the most important event of President Thomas Jefferson's first administration. In this transaction, the United States bought 827,987 square miles (2,144,476 square kilometers) of land from France for about $15 million. This vast area lay between the Mississippi River and the Rocky Mountains, stretching from the Gulf of Mexico to the Canadian border. The purchase of this land greatly increased the economic resources of the United States, and cemented the union of the Middle West and the East. Eventually all or parts of 15 states were formed out of the region.

Reasons for the purchase. When Jefferson became president in March 1801, the Mississippi River formed the western boundary of the United States. The southern boundary extended to the 31st parallel north latitude. The Floridas (with West Florida extending to the Mississippi and including New Orleans) lay to the south, and the Louisiana Territory to the west. Spain owned both these territories.

Farmers who lived west of the Appalachian Mountains shipped all their surplus produce by boat down rivers that flowed into the Gulf of Mexico, especially the Mississippi. In a treaty of 1795, Spain agreed to give Americans the "right of deposit" at New Orleans. This right allowed Americans to store in New Orleans, duty-free, goods shipped for export. Arks and flatboats transported a great variety of products, including flour, tobacco, pork, bacon, lard, feathers, cider, butter, cheese, hemp, potatoes, apples, salt, whiskey, beeswax, and bear and deer skins.

Spain suspended the right of deposit in 1798, arousing a strong reaction among Westerners. In 1800, Spain transferred Louisiana to France in the secret Treaty of San Ildefonso. Emperor Napoleon I of France assigned an army and a general for the occupation of Louisiana, but Spanish authorities continued to govern. In June 1801, Spanish governor Don Juan Manuel de Salcedo replaced Governor Casa Calvo, and the right of deposit for United States goods was reinstated for a short time.

Trouble begins. In the same month that Jefferson became president, the United States minister to the United Kingdom, Rufus King, heard that Spain planned to give part of its American colonies to France. Jefferson feared that an ambitious nation such as France might interfere with the trade of the western territories. He believed that Spain would cede the Floridas to France, and quickly directed his diplomats to prevent this transfer. Secretary of State James Madison warned the French chargé d'affaires, Louis Pichon, that the United States expected to have an outlet to the sea. Robert Livingston, who was the newly appointed minister to France, sailed for that country in September 1801. He had received instructions to inform the French government that the United States was not willing to see the American colonies of Spain transferred to any country except the United States.

In November 1801, King sent Madison a copy of the treaty in which Spain ceded Louisiana to France. But Jefferson still did not know just how much territory this included. He instructed Livingston to prevent the cession if possible. If it had already taken place, Livingston was to persuade France to transfer the Floridas, especially West Florida, to the United States. New Orleans lay on the east side of the river, so it would become a possession of the United States. Napoleon spurned Livingston's proposals.

A French colonial official sent by Napoleon to receive the transfer of Louisiana from Spain to France arrived in New Orleans in March 1802. But the French army intended for Louisiana was diverted to the colony of Santo Domingo in the French West Indies to suppress a slave rebellion. Though the rebellion was stopped, yellow fever and continuing rebel activities reduced French forces, and the transfer of Louisiana to France was delayed.

Jefferson arranged for his friend, Pierre du Pont de

The Louisiana Purchase doubled the area of the United States. This 1803 treaty with France extended the western U.S. boundary from the Mississippi River to the Rocky Mountains. Part or all of 15 states were later formed from the region.



WORLD BOOK maps



Nemours, to carry dispatches to Livingston and to help him influence the French government against acquiring the American Colonies. Du Pont's instructions read as follows: "... you may be able to impress on the government of France the inevitable consequences of their taking possession of Louisiana.... This measure will cost, and perhaps not very long hence, a war which will annihilate her on the ocean...." Du Pont was to warn France that if it annexed Louisiana, the United States would form an alliance with Britain against France. Du Pont felt that this ultimatum might make Napoleon even more determined to acquire the desired territory. Being a businessman, he suggested that the United States offer to buy the Floridas, paying as much as $6 million. This seems to be the first suggestion of buying the territory.

New Orleans closed to Americans. Meanwhile, Jefferson's worst fears seemed to be confirmed when, on Oct. 18, 1802, Governor Salcedo again suspended the right of deposit. He was following orders received from Spain, probably dictated by Napoleon, but the action was made to appear as his own decision. The governor of the Mississippi Territory warned Madison: "The late act of the Spanish Government at New Orleans has excited considerable agitation in Natchez and its vicinity:—It has inflicted a severe wound upon the Agricultural and Commercial interests of this Territory, and must prove no less injurious to all the Western Country." Madison protested to the Spanish government and also warned Napoleon through Pichon that Americans were people of action and were aroused by a war fever.

Napoleon refused to abandon his hopes of building an empire in America. The news of a military defeat in Santo Domingo only caused him to send another 15,000 French troops there. Livingston was discouraged. Jefferson decided to send James Monroe to France to support Livingston in his negotiations with the French government. Congress voted $2 million which the two envoys could use in trying to purchase the east bank of the Mississippi. Jefferson privately advised them to offer as much as $9,375,000 for the Floridas and New Orleans. If France rejected their offer, they were to try to obtain at least the right of deposit at New Orleans.

Napoleon's decision. Napoleon knew that war with Britain would soon break out again. Pichon warned him that the Americans might seize Louisiana as soon as France became engaged in a European war, and that the British navy might seize the territory. Napoleon also feared the possibility of an Anglo-American alliance. Pichon had warned that the United States was considering sending 50,000 troops to take New Orleans by force. American newspapers describing the war ferment seemed to substantiate this warning.

On April 10, 1803, Napoleon notified his finance minister, François de Barbé-Marbois, that he was considering ceding all the Louisiana Territory to the United States. Monroe arrived in Paris just after Marbois had offered Livingston the whole of Louisiana. Jefferson had instructed the two envoys to purchase only the Floridas, but they felt confident that the United States would accept this larger offer. They agreed to Marbois's price of 60 million francs plus the assumption of American claims against France (a total of about $15 million). The treaty, dated April 30, was signed May 2. It reached Washington on July 14, 1803.

Ratifying the treaty. The Constitution did not authorize the acquisition of land, but it did provide for the making of treaties, so that Jefferson felt the acquisition of new territory was constitutional. He admitted that he had "stretched the constitution until it cracked." But he thought of himself as a guardian who made an investment of funds entrusted to his care. In a message to Congress on Oct. 17, 1803, Jefferson said: "Whilst the property and sovereignty of the Mississippi and its waters secure an independent outlet for the produce of the Western States and an uncontrolled navigation through their whole course, ... the fertility of the country, its climate and extent, promise in due season important aids to our Treasury, an ample provision for our posterity, and a wide spread for the blessings of freedom and equal laws." The U.S. Senate ratified the treaty on October 20. Laws were passed to provide for borrowing the money from English and Dutch banks. These debts were payable in 15 years. The United States officially took possession of the territory on Dec. 20, 1803. See **Louisiana** (History).

Boundary disputes arose over the Louisiana Territory, because the treaty did not state specific boundaries. The United States and Britain agreed in 1818 to establish the northern boundary at the 49th parallel. In the south, the United States claimed West Florida and part of Texas. Jefferson pointed out that as early as 1696 France had possession of the Gulf Coast from Mobile westward, and that in 1755 maps published by the French government showed the Perdido River as the eastern boundary of France's possessions. This, Jefferson claimed, was part of the land that Spain gave back to France in 1800, and therefore part of the purchase. In the Adams-Onís Treaty of 1819 with Spain, the United States acquired Florida and surrendered its claim to Texas. Spain in return gave up its claim to West Florida. Henry C. Dethloff

Additional resources

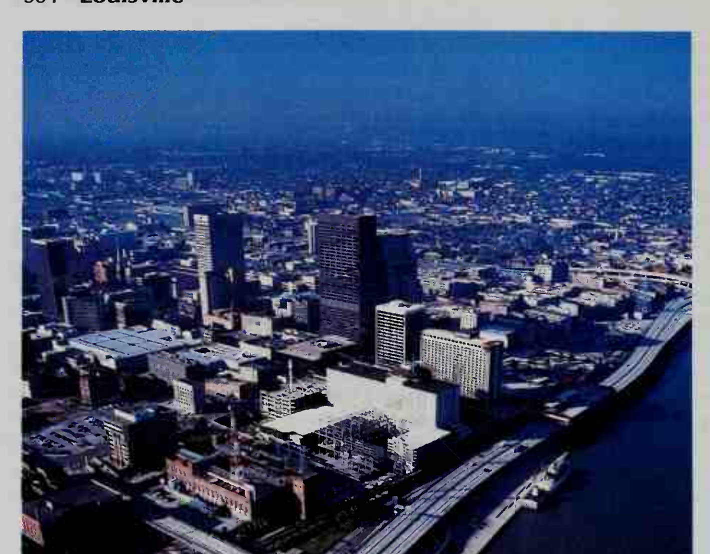
Phelan, Mary K. *The Story of the Louisiana Purchase.* T. Y. Crowell, 1979. Younger readers.
Sprague, Marshall. *So Vast, So Beautiful a Land: Louisiana and the Purchase.* 1974. Reprint. Swallow, 1991.

Louisiana State University (LSU) is a coeducational state-supported university system. Its main campus is in Baton Rouge. The LSU Medical Center has two campuses in New Orleans and one in Shreveport. The LSU Agricultural Center has an office in Baton Rouge and 16 research stations. The system also includes Louisiana State University in Shreveport, the University of New Orleans, two-year campuses in Alexandria and Eunice, and the Paul M. Hebert Law Center.

The campus in Baton Rouge has colleges of agriculture, arts and sciences, basic sciences, business administration, design, education, and engineering; a school of music; and a division of continuing education. It also has a graduate school; professional schools of library and information science, social work, and veterinary medicine; and a center for wetland resources.

LSU was founded in Pineville in 1855 as the Louisiana State Seminary of Learning and Military Academy. The name was changed to Louisiana State University in 1870, and the institution merged with the Agricultural and Mechanical College in 1877.

Critically reviewed by Louisiana State University



John Nation



Jim Reed, *Louisville Magazine*

Louisville, the second largest city in Kentucky, lies on the Ohio River. The downtown Riverfront Plaza includes a pool with stepping stones that help provide an attractive setting.

Louisville, *LOO ee* VIHL or *LOO ih* VUHL, is the second largest city in Kentucky and a major industrial center of the Southeast United States. Louisville serves as an important transportation link between the North and the South. The city lies on the Ohio River along the northern boundary of Kentucky. It grew up beside the falls of the river, and it is sometimes called the *Falls City.* About a fifth of Kentucky's people live in the Louisville metropolitan area.

The Kentucky Derby, one of the world's most famous horse races, is held at Churchill Downs in Louisville on the first Saturday in May. The race draws more than 100,000 spectators each year.

In 1778, a group of pioneers led by the American explorer George Rogers Clark established a settlement on the site of what is now Louisville. The next year, Clark named the town for King Louis XVI of France. He did so in gratitude for France's help to the American Colonies during the Revolutionary War in America (1775-1783).

River trade accounted for much of Louisville's early development. After World War II ended in 1945, the city's industry expanded rapidly.

The city covers 65 square miles (168 square kilometers)—including about 5 square miles (13 square kilometers) of inland water—in Jefferson County. It is the seat of Jefferson County. The Louisville metropolitan area spreads over all of Jefferson, Bullitt, and Oldham counties in Kentucky and Clark, Floyd, Harrison, and Scott counties in Indiana. Low, rolling hills rise to the south and to the east of the city.

Downtown Louisville consists mainly of an area 1 mile square (2.6 square kilometers), bordered by the Ohio River, First Street, Tenth Street, and Broadway. Most of the city's large banks, hotels, and stores are within this area. The downtown section also includes city, county, and federal government buildings. This section is the site of two convention centers, Louisville Gardens and the Commonwealth Convention Center. A statue of George Rogers Clark and a stained-glass window with scenes of Louisville's history are features of the Riverfront Plaza, located on the Ohio River between Fourth and Sixth streets.

Four bridges across the Ohio River link Louisville with the Indiana cities of Clarksville, Jeffersonville, and New Albany. Freeways connect downtown Louisville with the city's suburbs. The United States government keeps its gold reserve in huge vaults at Fort Knox, which is an

Facts in brief

Population: *City*—256,231. *Metropolitan area*—1,025,598.
Area: 65 mi² (168 km²). *Metropolitan area*—2,072 mi² (5,366 km²); excluding inland water.
Altitude: 450 ft (137 m) above sea level.
Climate: *Average temperature*—January, 35 °F (2 °C); July, 78 °F (26 °C). *Average annual precipitation* (rainfall, melted snow, and other forms of moisture)—42 in (107 cm). For the monthly weather in Louisville, see **Kentucky** (Climate).
Government: Mayor-council. *Terms*—4 years for the mayor and 2 years for the 12 council members (aldermen).
Founded: 1778. Incorporated as a city in 1828.

Army base located 30 miles (48 kilometers) south of Louisville.

The people. More than 98 percent of Louisville's people were born in the United States. The city's population includes large groups of people of English, German, and Irish descent. Blacks make up about a third of the population. Most of the blacks live in the West End district and in the central city. Slums and unemployment are problems in both of these areas.

Economy. The Louisville metropolitan area has about 1,300 factories. The area is one of the largest tobacco-manufacturing centers in the United States. It is also one of the country's largest producers of gin and whiskey. Other major products include chemicals, electric appliances, motor vehicles, paint, and sporting goods. Lumber milling, meat packing, and printing are also important industries. The American Printing House for the Blind, the world's largest publisher of braille products, is located in Louisville.

Louisville, a major river port, is linked by towboats and barges with other communities on the Ohio and Mississippi rivers. Freight railroads and more than 130 truck lines also serve the Louisville area. Most commercial airliners use Louisville International Airport, and Bowman Field serves smaller planes.

Louisville has one daily newspaper, *The Courier-Journal.* Twenty-seven radio stations and eight television stations broadcast from the city.

Louisville's economy has grown since the late 1940's. During the 1970's and 1980's, the city experienced a decline in manufacturing, including the loss of a large cigarette plant, a major farm implements builder, and thousands of appliance industry jobs. However, an increase in service industry activities—such as health care, finance, air cargo delivery, and tourism—took place during the same period and helped offset the manufacturing losses.

Industrial development led to increased air pollution in the Louisville area. Local governments passed pollution control laws to reduce this problem.

Education. The Jefferson County Public School District includes all the public elementary and high schools in Louisville and most of the rest of Jefferson County. It has a total enrollment of about 97,000 students. Blacks make up about 30 percent of the enrollment. In 1975, a court-ordered busing program designed to desegregate Louisville area schools began in the district. Under the program, several thousand black children were bused from the city to suburban schools, and several thousand white children rode buses to schools in Louisville. In 2000, a federal judge ended the court-ordered busing program. He declared that forced integration was not needed. He said the racially separate system that had once made it necessary no longer existed. More than 20,000 students attend about 85 parochial and private schools in Jefferson County.

Louisville has several colleges and universities. The University of Louisville was the first city-owned university in the United States. It was founded in 1798. Other institutions of higher learning include Bellarmine University, Jefferson Community College, Louisville Presbyterian Theological Seminary, Southern Baptist Theological Seminary, Spalding University, and Sullivan College. The Kentucky School for the Blind is also in Louisville.

Some colleges in the Louisville area have had financial troubles. Kentucky Southern College closed in 1969 because of a shortage of funds. The University of Louisville operated under municipal control until 1970. But, faced with rising costs, the university became a state-supported school that year.

The Louisville Free Public Library, founded in 1816, was one of the nation's first public library systems. It has about 20 branches.

Cultural life. The Kentucky Opera Association, the Louisville Ballet Company, and the Louisville Orchestra perform at the Kentucky Center for the Arts downtown. The Actors Theatre of Louisville is the home of the city's professional resident theater company. The Memorial Auditorium presents dance productions, plays, and concerts. The Playhouse, which is on the University of Louisville campus, offers plays and other stage productions. Central Park presents a series of Shakespearean plays each summer. Louisville Gardens is used for such events as concerts, circuses, and sports contests.

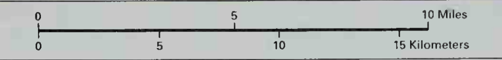
City of Louisville

Louisville, the largest city in Kentucky, is a major port on the Ohio River. The map shows important points of interest in and around Louisville.

City boundary
County boundary
State boundary
Expressway
Other road
Railroad
Point of interest
Park

Louisville
KENTUCKY





WORLD BOOK map

The J. B. Speed Art Museum, on the University of Louisville campus, features traveling art shows in addition to its own collection. The Museum of History and Science offers a variety of exhibits. The Kentucky Railway Museum at nearby New Haven has a collection of steam locomotives and trolley and railroad cars from the 1800's. The Kentucky Derby Museum at Churchill Downs features displays about horse racing. The Louisville Automobile Museum shows vintage cars. The Filson Club has exhibits of Kentucky history.

Recreation. Jefferson County has about 11,000 acres (4,450 hectares) of parks and playgrounds. Iroquois Park includes a large amphitheater for summer musicals. The 396-acre (160.3-hectare) Kentucky Fair and Exposition Center is one of the largest exhibition centers and fairgrounds in the United States. Its coliseum hosts conventions and other events. The Louisville Zoological Garden features a MetaZoo, an indoor exhibit that includes a recreation of a Kentucky pond.

Horse racing is one of the city's most popular sports. Races are held in the spring and fall at Churchill Downs.

Louisville has many historical attractions. Locust Grove, the home of George Rogers Clark; and Farmington, a house designed by Thomas Jefferson—the 3rd president of the United States—draw many tourists. Other historic places include the Cave Hill Cemetery, where Clark is buried; and the Zachary Taylor National Cemetery, the burial place of Taylor, the 12th president.

Government. Louisville has a mayor-council government. The voters elect the mayor to a four-year term. They elect the 12 members of the city council—called the Board of Aldermen—to two-year terms. Property taxes provide the government's main source of income.

The Louisville city government, like that of many other city governments, lacks *home rule* (self-government). Louisville must have the approval of the state legislature to act on many local matters. Legislators from rural areas often oppose measures that would benefit Louisville and other cities. Some city officials favor the establishment of a government for the Louisville metropolitan area. They feel that such a government could cut costs that result from overlapping city and suburban services. Suburban voters have opposed a metropolitan government for a variety of reasons, including a fear that such a government would result in higher taxes.

History. In 1778, the explorer George Rogers Clark led a group of pioneers from Pennsylvania down the Ohio River. After a brief stay on an island in the river, the pioneers established a settlement on the shore of the Ohio. The town was named Louisville in 1779. By 1800, about 350 people lived there.

Louisville's location helped make the town an important river port and frontier community. The first oceangoing ship to reach Louisville arrived in 1800. In 1811, the *New Orleans* became the first steamship to dock there. Louisville received a city charter in 1828. The Portland Canal, completed in 1830, enabled ships to by-pass the falls of the river.

During the 1830's and 1840's, a large number of people moved to Louisville from the Eastern United States and from Europe. They were attracted by the city's economic opportunities, and they contributed greatly to Louisville's political and cultural development.

Kentucky became a major tobacco-producing state during the 1830's, and much tobacco processing took place in Louisville. By the 1840's, the city ranked as one of the top tobacco centers in the world. By 1850, the population of Louisville had risen to more than 43,000. The growth of railroads during the 1850's led to further growth for Louisville. By 1859, train service had begun between Louisville and Nashville, Tennessee.

During the American Civil War (1861-1865), both Northern and Southern sympathizers lived in Louisville. But Kentucky remained in the Union, and Louisville became a supply depot for Northern troops. All trade was cut off with the South. A period of prosperity followed the war. Louisville business people regained their Southern markets, and railroads connected Louisville with Atlanta, New Orleans, and other Southern cities. By 1870, more than 100,000 people lived in Louisville.

Since the opening of Louisville's first race track in 1830, horse racing has been a leading sport in the city. Many of the horses have been raised in Kentucky's famous bluegrass pastures. In 1874, a group of sportsmen founded the Louisville Jockey Club. Each of the 320 original members contributed $100. Colonel M. Lewis Clark, a horse breeder, used this money to build Churchill Downs. The first Kentucky Derby was held there in 1875. By 1900, Louisville's population had reached about 205,000.

In 1937, the Ohio River overflowed its banks and swept through the city. The flood caused over $52 million in damage. A floodwall now protects the city.

During World War II (1939-1945), the United States government built three large ammunition plants in the Louisville area. Workers flocked to the city from rural communities to take factory jobs. The Army trained fliers at Bowman Field and infantrymen at Fort Knox. The increased defense activities helped raise the population to about 370,000 by 1950.

Racial progress took place in Louisville during the 1950's and 1960's. Peaceful desegregation of the public schools began in 1954, and all public accommodations were integrated in 1960.

The 1950's, 1960's, and 1970's brought rapid physical changes to Louisville. A number of expressways were built. The city also began a major beautifying program for downtown Louisville, including construction of public greens and fountains. In one project, the city built the Fourth Avenue Mall on three blocks of centrally located Fourth Street. In the early 1970's, the downtown redevelopment led to construction of new office buildings and a second convention center. The University of Louisville opened a modern medical center with a large hospital. Private developers built a hotel and bank buildings along the waterfront.

During the 1970's and 1980's, economic changes led to a loss of thousands of manufacturing jobs in the Louisville metropolitan area. Partly as a result, the city's population fell by about 90,000 from 1970 to 1990. The suburban population increased rapidly during the 1970's, but the increase slowed during the 1980's. The growth of service industries in the area helped make up for the manufacturing decline. In 1982, United Parcel Service (UPS) established a major cargo shipping center in Louisville. Growth also took place in health care and other service industries.

Downtown redevelopment continued in the 1980's and 1990's. It included the construction of the Galleria, which

has many shops and two office towers. The Humana Building, designed by Michael Graves, became a local landmark. Louisville took steps to restore a group of buildings with cast iron facades along Main Street that date from the 1800's. Efforts to reclaim the riverfront include the construction of a Great Lawn for performances and festivals. The city's population declined in the 1990's, but the population of the metropolitan area grew. William L. Ellison, Jr.

See also **Kentucky** (pictures); **Kentucky Derby**.

Lourdes, *loord* or *loordz* (pop. 15,679), is a town in southwestern France near the Pyrenees foothills (see **France** [political map]). It is famous as a shrine for Roman Catholic pilgrims. It is believed that there, in 1858, the Virgin Mary appeared to a peasant girl, Bernadette Soubirous. A beautiful church, called the Rosary, and a statue of the Virgin stand at the grotto where the vision occurred. See **Bernadette, Saint**.

About 2 million pilgrims visit Lourdes each year. Many people go there in search of a miraculous cure for a physical problem. Many bathe in the sacred waters of the grotto spring in hope that a miracle will restore them to health. Some people leave their crutches as evidence of a cure. The visitors come all year long. Many French Roman Catholics make a pilgrimage to Lourdes for ceremonies on August 20 of each year. The underground Basilica of St. Pius X in Lourdes, opened in 1958, is the second largest Roman Catholic church in Europe. Only St. Peter's Basilica in Vatican City can accommodate more people. William M. Reddy

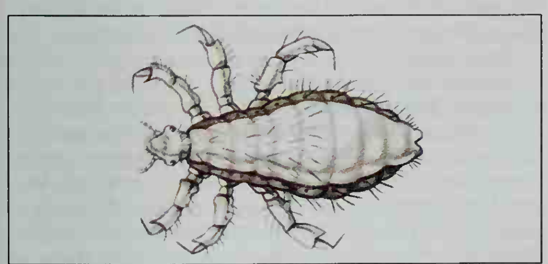
Lourenço Marques. See **Maputo**.

Louse is a small, wingless insect that lives on birds and mammals, including human beings. Lice are parasites that feed on the animal on which they live. This animal is called the *host*. Lice cause severe itching and can spread disease.

There are two chief kinds of lice, *chewing lice* and *sucking lice*. Chewing lice, also called *bird lice,* have a mouth designed for chewing. They most commonly are found on birds and feed on the feathers, hair, or skin of the host. Chewing lice are 10 times more abundant than sucking lice and often occur on domestic animals, especially farm fowl. They do not attack human beings.

Sucking lice have sucking mouth parts. These lice pierce the host's skin and feed on its blood. Each leg of a sucking louse has a claw at the end. The louse uses its claws to attach itself to hairs on the body of the host.

Several species of sucking lice live on human beings. One species, *Pediculus humanus,* is found on human beings exclusively. There are two varieties of this species, the *head louse* and the *body louse*. Head lice, commonly called *cooties,* live in the hair of the host. They attach their *nits* (eggs) to hairs by means of a gummy substance. Head lice pass from one person to another through direct contact or the shared use of combs, hats, and other items for the head. Body lice, which are also known as *seam squirrels,* lay their nits in the seams of the host's clothing. Body lice often remain with the clothing or bedding of an infected individual and tend to wander from the clothing of one person to that of another. Body lice can carry and transmit diseases. The most serious of these is epidemic typhus, which can cause death (see **Typhus**).



WORLD BOOK illustration by Carol A. Brozman

A body louse has crablike legs and hooked claws that it uses to cling to its victim. Its body is covered with tiny hairlike structures. The body louse feeds by piercing its victim's skin and drawing blood through a beaklike sucking organ.

The best way to discourage sucking lice is to bathe regularly and to wear clean clothes. To eliminate lice from the body, physicians may recommend dusting the body with an approved pesticide for lice, or the use of certain lotions or shampoos. Hot-water washing will usually rid clothes of lice.

Insects called aphids are sometimes referred to as *plant lice*. Aphids feed on plant juices. See **Aphid**.

Sandra J. Glover

Scientific classification. Lice are members of the class Insecta. Chewing lice make up the order Mallophaga. Sucking lice belong to the order Anoplura.

See also **Head lice**.

L'Ouverture, Toussaint. See **Toussaint L'Ouverture**.

Louvre, *LOO vruh,* is one of the largest and most famous art museums in the world. The Louvre covers more than 40 acres (16 hectares) on the north bank of the Seine River in Paris. The Louvre was built as a residence for the kings of France, but today it exhibits some of the world's greatest art treasures.

The Louvre has about 8 miles (13 kilometers) of galleries and more than a million works of art. Many paintings are exhibited in the Grand Gallery, which is more than 1,300 feet (400 meters) long. The Louvre has especially fine collections of Egyptian, Greek, Asian, and Roman art. It also has an outstanding collection of paintings and sculptures of the 1800's as well as decorative art. The Louvre's most famous works include the Greek sculptures *Venus de Milo* and *Winged Victory* and the *Mona Lisa* by the Italian painter Leonardo da Vinci.

King Philip II originally built the Louvre as a fortress in about 1200. King Charles V had the building remodeled into a fortified country house during the mid-1300's. The Louvre began to take on its present appearance in the mid-1500's. In 1546, King Francis I decided to transform the building into a palace that would rival the greatest structures of Renaissance Italy. Francis hired the French architect Pierre Lescot to direct construction. Jean Goujon, a French sculptor, decorated the palace and its grounds with statues inspired by Greek and Roman models. Later kings added large courts and long wings to the original building.

The period of expansion ended in 1670 with the completion of the Louvre's east front designed by Claude Perrault. A few years later, Louis XIV moved the royal court to a new palace at Versailles, near Paris. In 1793, during the French Revolution, the revolutionary government opened the Louvre as a public museum to display works from the captured royal collection. Construction

on the museum resumed under Napoleon I in the early 1800's, and the Louvre gained its modern form in the mid-1800's with the completion of two wings. A major expansion and modernization project designed by American architect I. M. Pei began in 1984. The first sections opened to the public in 1989. William J. Hennessey

See also **Paris** (Famous buildings; picture: The Venus de Milo).

Love. See **Emotion; Sexuality.**

Love, Nat (1854-1921), was an African American cowboy of the Old West. Love worked in cattle drives for about 20 years, traveling across the western United States and Mexico. He became known for his expert horsemanship and his ability to identify cattle brands.



Library of Congress

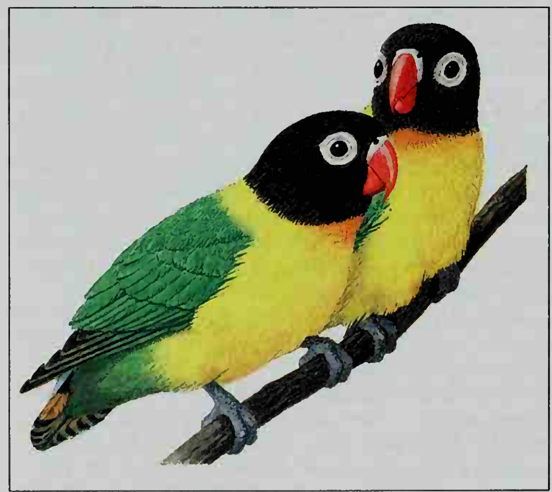
Nat Love

Love was born a slave in Davidson County, Tennessee. He left home when he was 15 years old and went to work as a cowboy near Dodge City, Kansas. He worked in cattle drives until 1889. He became a railroad porter in 1890.

Love was nicknamed "Deadwood Dick" after he won a riding, roping, and shooting contest in Deadwood, South Dakota, in 1876. His autobiography, *The Life and Adventures of Nat Love, Better Known in the Cattle Country as Deadwood Dick* (1907), contains many cowboy stories. It includes tales about such famous Western characters as Bat Masterson, Billy the Kid, Buffalo Bill, and Jesse James. However, like many other legends of the Old West, Love's stories are greatly exaggerated, and his true adventures are difficult to distinguish from the "tall tales."

Raymond W. Smock

Lovebird is any one of several kinds of small parrots. They are called *lovebirds* because the mating birds show great affection, caressing each other with their bills and remaining in closely knit pairs.



WORLD BOOK illustration by John Rignall, Linden Artists Ltd.

Lovebirds are small colorful parrots that live wild in tropical Africa. The birds also are popular pets.

True lovebirds live in Africa. They eat seeds and fruit. Some species have a remarkable way of carrying grass and straw to their nests. They tuck these materials under the feathers at the base of the tail. Then they fly to their nests with the grasses and straws streaming behind. Lovebirds in captivity frequently tear strips of paper or pick up pieces of string to tuck beneath their feathers.

Lovebirds have curved beaks and short tails that are typical of the parrot family. They are popular cage birds.

John W. Fitzpatrick

Scientific classification. Lovebirds belong to the family Psittacidae. They are members of the genus *Agapornis.*

Lovebug is an insect that forms huge swarms when mating. The insects are called lovebugs because mating adults may remain coupled end-to-end for up to three days. Lovebugs are actually flies, not bugs. They live in the United States near the Gulf of Mexico, in eastern Mexico, and in parts of Central America. Swarming lovebugs are a nuisance near highways and residential areas. The insects spatter against automobile windshields and clog automobile radiators. They also stick to walls of newly painted houses.

Lovebugs usually mate in May and September. Immense swarms of the males hover over pastures and drained swampland. When the females enter the swarm, they pair with males and fly to the ground, coupling within a few minutes. The coupled pair then returns to the air and drifts or flies to flowers, where the female feeds on nectar and pollen. After mating has been completed, the female flies to the ground to lay her eggs.

E. W. Cupp

Scientific classification. The lovebug belongs to the March fly family, Bibionidae. It is *Plecia nearctica.*

Lovecraft, H. P. (1890-1937), an American author, was one of the major writers of supernatural and horror fiction of the 1900's. Lovecraft's novels and stories show his fascination with dark forces in New England settings that sometimes seem realistic and other times seem fantastic and dreamlike. Much of Lovecraft's fiction explores the sensation of the "weird." In many of his tales, the characters and the reader are forced into an awareness that humanity has an uncertain and relatively insignificant place in the universe.

Howard Phillips Lovecraft was born in Providence, Rhode Island, where he lived most of his life. He wrote his first supernatural story, "Dagon," in 1917. It was published in 1923 in *Weird Tales* magazine, the magazine that published many of his stories. Nearly all his fiction was published in book form only after his death.

William A. Kumbier

See also **Derleth, August.**

Lovejoy, Elijah Parish (1802-1837), was an American clergyman and newspaper editor noted for his opposition to slavery. In 1833, he founded a Presbyterian newspaper, the *St. Louis Observer,* in which he attacked slavery. After many proslavery protests against him, Lovejoy moved across the Mississippi River to Alton, Illinois, in 1836. There he published the *Alton Observer* and helped organize the Illinois Anti-Slavery Society. Supporters of slavery wrecked three of his presses and, in November 1837, a mob gathered to destroy his newest press. Lovejoy was killed trying to stop them. Many

Northerners became abolitionists after his death.

Lovejoy was born in Albion, Maine. He attended Waterville College (now Colby College) and Theological Seminary in Princeton, New Jersey. Michael F. Holt

See also **Phillips, Wendell.**

Lovelace, Richard (1618-1657), was a member of a group of English lyric poets called the *Cavalier* poets. These poets emphasized ideals of love, beauty, and honor. Lovelace is known chiefly for a few famous lines. "Stone walls do not a prison make, / Nor iron bars a cage" comes from the poem "To Althea, from Prison" (1642). "I could not love thee, dear, so much, / Loved I not honor more" appears in the poem "To Lucasta, Going to the Wars" (1648).

Lovelace was born either in Woolwich or in the Netherlands. He was educated at Oxford University. Lovelace served as a soldier in the army of King Charles I. He was imprisoned twice during the civil war that broke out in 1642. He wrote his two famous poems in prison. Lovelace lost his estate while he was serving the king, and he died in poverty. Gary A. Stringer

Lovell, *LUHV uhl,* **Sir Bernard** (1913-), an English astronomer, built the world's first completely steerable radio telescope. This telescope can be pointed in any direction. Lovell became famous for tracking the first artificial satellite, the Soviet Union's Sputnik 1, in October 1957. The telescope has a reflector 250 feet (76.2 meters) in diameter that focuses radio waves on an antenna in the center of the reflector. It is called the Jodrell Bank telescope after its site near Manchester, England.

Lovell was born in Gloucestershire and studied physics at Bristol University. During World War II (1939-1945), he worked with radar and became interested in radio astronomy. Queen Elizabeth II knighted Lovell in 1961. Roger H. Stuewer

See also **Jodrell Bank Observatory.**

Lovell, *LUHV uhl,* **James Arthur, Jr.** (1928-), was a United States astronaut. In 1965, Lovell and Frank Borman established a space endurance record by spending 14 days in earth orbit aboard the Gemini 7 spacecraft. During this mission, Lovell and Borman achieved the first *rendezvous* (close approach) in space with the Gemini 6 spacecraft piloted by Walter M. Schirra, Jr., and Thomas P. Stafford.

In 1966, Lovell commanded the Gemini 12 flight. In December 1968, he served as command module pilot aboard Apollo 8. On Christmas Eve, he, Borman, and William A. Anders became the first people to circle the moon.

In April 1970, Lovell commanded the Apollo 13 mission, intended to be NASA's third lunar landing. An explosion in the spacecraft's service module resulted in a severe loss of electric power and oxygen. Lovell and crewmates Fred W. Haise, Jr., and John L. Swigert, Jr., survived in the lunar module while they circled the moon and returned to the earth. Prior to reentry, the crew cast off the service and lunar modules. They used the command module to make a safe splashdown.

Lovell was born in Cleveland. He attended the University of Wisconsin from 1946 to 1948 and graduated from the U.S. Naval Academy in 1952. He served as a test pilot and flight instructor before becoming an astronaut in 1962. Lovell resigned from the astronaut program in 1971. Lillian D. Kozloski

Low, Juliette Gordon (1860-1927), founded the Girl Scouts in America. Among her close friends were Sir Robert and Lady Baden-Powell, the founders of Scouting. Low organized a troop of Girl Guides on her estate at Glenlyon, Scotland. On her return to the United States, she began a patrol in Savannah, Georgia, in 1912. In 1913, the organization changed its name to Girl Scouts (see **Girl Scouts**). It was incorporated in 1915 and set up headquarters in Washington, D.C. Low served as president of the Girl Scouts until 1920, when she received the title of *Founder.*

Juliette Gordon was born in Savannah. She married a wealthy Englishman, William M. Low, and lived in England, Scotland, and the United States. Juliette Low also was a talented sculptor. Alan Keith-Lucas

Low Countries are coastal regions located between France and Germany. The Low Countries were once known as *the Netherlands,* but were later divided into Belgium, Luxembourg, and the Netherlands. Each of the Low Countries has a separate article in *World Book.*

Löwchen, *LOH chuhn,* is a small, lively breed of dog. It stands from 12 to 14 inches (30 to 36 centimeters) tall at the shoulders and weighs from 12 to 18 pounds (5.4 to 8.2 kilograms). The breed originated more than 500 years ago in Europe, where it was groomed in the likeness of a lion. *Löwchen* means *little lion* in German.



© American Kennel Club (photo by Mary Bloom)

The löwchen has a lionlike mane of long, soft hair.

The dog has a long, flowing mane of soft, slightly wavy hair. Its coat is customarily trimmed short on the hindquarters, feet, and part of the forelegs and tail. Löwchen are also characterized by a sturdy and compact body, proud gait, and outgoing personality. They make intelligent, affectionate pets and are easily trained.

Critically reviewed by the American Kennel Club

Lowell, *LOH uhl,* Massachusetts (pop. 105,167; met. area pop. 301,686), is a city in the northeastern part of the state. It lies along the Merrimack River (see **Massachusetts** [political map]). Lowell is best known as the nation's first planned industrial community. It was founded in the early 1800's by textile manufacturers. In 1978, the part of Lowell where early textile manufacturing was centered became a national historical park. That event helped lead to a redevelopment of the region.

Lowell's historic sites include the restored Francis Gatehouse and Merrimack Gatehouse. The gatehouses formerly served as locks that controlled the water level in the city's canal system. The canals provided water power to run the textile mills. Lowell's Visitor Center has exhibits of fabrics and of looms and other machinery used in the mills. The birthplace of the painter James Abbott McNeill Whistler is in Lowell and is preserved as a museum. Other museums include the Boott Cotton Mills Museum and the New England Quilt Museum.

Textile manufacturing is still performed in Lowell. However, research companies, educational institutions, and service industries are the city's major employers.

Lowell was incorporated as a town in 1826, and as a city in 1836. It was named for the American textile manufacturer Francis Cabot Lowell. Lowell has a council-manager form of government. Both Lowell and the city of Cambridge serve as the seats of Middlesex County.

Laurence A. Lewis

Lowell, *LOH uhl,* **Amy** (1874-1925), was an American poet, critic, and biographer. Like a number of other poets of her day, Lowell was strongly influenced by the American poet Ezra Pound. She was particularly influenced by Pound's belief that many poetic conventions of the past were worn out and restricted the poet's creativity. With Pound and other poets, Lowell became a leader of a movement called *imagism.* The imagists emphasized the clear, objective, and precise treatment of images, objects, and events. They wrote in a style known as *free verse* (see **Free verse**).

Lowell experimented with her own version of free verse, beginning with her second volume of poems, *Sword Blades and Poppy Seed* (1914). Her poems "Patterns" and "Lilacs" were experimental works that came to represent what was considered "modern" in poetry. "Patterns" was published in her collection *Men, Women, and Ghosts* (1916). "Lilacs" was published in *What's O'Clock* (1925), a collection that won the Pulitzer Prize for poetry in 1926, after the author's death.

Amy Lawrence Lowell was born in Brookline, Massachusetts. She had a colorful personality and was known for her unconventional lifestyle. Her *Complete Poetical Works* was published in 1955. Steven Gould Axelrod

Lowell, *LOH uhl,* **Francis Cabot** (1775-1817), an American textile manufacturer, founded the first mill that carried through the entire cotton-manufacturing process from raw material to finished cloth. In 1810, Lowell was allowed to inspect the Lancashire cotton mills in England. On his return, he and Paul Moody designed spinning and weaving machinery superior to the best English models. Lowell installed these machines in a mill at Waltham, Massachusetts, which he and others had established in 1814. He also planned good living conditions for his workers. After his death, his associates put this plan into effect in the city of Lowell, Massachusetts, which was named for him. This city became an early site of the Industrial Revolution in the United States. Lowell was born in Newburyport, Massachusetts.

Richard F. Hirsh

Lowell, *LOH uhl,* **James Russell** (1819-1891), was an American author who played an important part in the cultural life of the United States during the 1800's. In his own day, Lowell became best known as a poet, but he was also a noted editor, literary critic, lecturer, teacher, scholar, reformer, and diplomat.

Early career. Lowell was born in Cambridge, Massachusetts, and was from a noted New England family. He graduated from Harvard University in 1838 as class poet.

Beginning about 1840, Lowell wrote poetry and prose for many magazines and newspapers. In 1843, Lowell and a friend, Robert Carter, founded *The Pioneer,* a literary magazine. They published works by such noted authors as Elizabeth Barrett Browning, Nathaniel Hawthorne, Edgar Allan Poe, John Greenleaf Whittier, and Lowell himself. *The Pioneer* showed promise of growing into a major cultural periodical. But after Lowell became ill, it failed financially and ceased publication after three issues. During the late 1840's, Lowell contributed to several abolitionist publications, including the *National Anti-Slavery Standard,* which he helped edit, and the *Pennsylvania Freeman.*

Literary success. Lowell reached the peak of his literary achievement in 1848. Three of his best-known poetic works—*A Fable for Critics, The Biglow Papers,* and *The Vision of Sir Launfal*—were published then.

The author's sense of humor dominates *A Fable for Critics* and *The Biglow Papers.* His humor and critical insight combine to make *A Fable for Critics* a good-natured verse satire on writers of his day, including Lowell himself. In *The Biglow Papers,* Lowell used humor for social criticism. This work consists of poems and prose notes that show Lowell's opposition to U.S. involvement in the Mexican War (1846-1848). Hosea Biglow, the chief character, is an uneducated but practical-minded New England farmer who speaks in a rural New England dialect. Lowell's comic treatment of this dialect earned him a lasting place among leading American humorists.

Lowell based *The Vision of Sir Launfal* on the legendary search for the Holy Grail, the cup or dish that Jesus used at the Last Supper. The poem has a moral and Christian theme. It represents Lowell's early idealism, but it is not an example of his best poetry. The hero is Sir Launfal, a mythical British knight (see **Launfal, Sir**). For quotations from the poem, see **June.**

Teacher and editor. Tragedy struck Lowell during the years that he became known as a leading poet. Between 1847 and 1852, three of his four children died. His wife, Maria, died in 1853. Although Lowell remained optimistic, he suffered periods of despondency that continued even after his marriage to Frances Dunlap in 1857. For several years, Lowell's grief over the deaths in his family hampered his ability to write. To earn a stable income, he took teaching and editing jobs.

In 1855, Lowell succeeded the famous poet Henry Wadsworth Longfellow as professor of modern languages at Harvard. He taught there from 1855 to 1872 and again from 1874 to 1876. From 1857 to 1861, he served as the first editor of *The Atlantic Monthly.* From late 1863 to 1872, he was coeditor of the *North American Review.* Under Lowell's leadership, both magazines achieved major literary and intellectual importance.

Lowell continued to write poetry, but his most important literary work after about 1860 was increasingly in prose. His essays on such famous authors as Dante Alighieri, William Shakespeare, and William Wordsworth showed his sharp critical judgment and literary taste. Lowell also wrote outspoken articles on social issues,

including the guarantee of full rights of citizenship to blacks.

During the 1860's, Lowell wrote some significant poetry, including a second series of *The Biglow Papers.* This series reflected his antislavery position and his support of the North during the American Civil War (1861-1865). He also wrote two impressive long poems, the *Commemoration Ode* (1865) and *The Cathedral* (1869).

Political activities. After the Civil War, Lowell became increasingly active in politics. He served as a delegate to the Republican National Convention in 1876 but declined an opportunity to run for Congress that year. Lowell supported the Republican presidential candidate, Rutherford B. Hayes. After Hayes became president, he appointed Lowell United States minister to Spain. Lowell held this post from 1877 to 1880 and then served as minister to England until 1885. During his years in Spain and England, Lowell became a popular figure in European society and a spokesman for American ideals of democracy.

In 1885, Lowell retired to Elmwood, the family home where he had been born. He lived quietly for the rest of his life but spoke at a number of public events.

Many volumes of Lowell's writings appeared during his lifetime. But except for *A Fable for Critics,* the two series of *The Biglow Papers,* and a few shorter poems, his work has been largely forgotten. Most of his poetry fell short of exellence. But he followed his conscience on humanitarian and social issues and served his country and the world of learning well. Sargent Bush, Jr.

Additional resources

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Lowell, Percival (1855-1916), an American astronomer, became best known for his belief in the possibility of life on Mars and in the existence of canals there. He began his career as a businessman. Soon, however, his interests turned to astronomy. In 1894, he completed the Lowell Observatory in Flagstaff, Arizona. He wrote several books, which had wider popular appeal than scientific value. In 1905, his studies led him to predict the discovery of the planet Pluto. Pluto was first detected at the Lowell Observatory after his death (see **Pluto**). Lowell was born in Boston. C. R. O'Dell

Lowell, Robert (1917-1977), was a leading American poet. Lowell often is considered a "confessional" poet because he used material from his private life to generate an image of modern culture. His poetry dramatizes the pain and tenderness of personal relationships, and his belief that society has been distorted by its overemphasis on worldly things. Lowell received the 1947 Pulitzer Prize for poetry for *Lord Weary's Castle* (1946) and the 1974 Pulitzer Prize for poetry for *The Dolphin* (1973).

Lowell's early poems dealt with the failures and strengths of religious and historical tradition. They were brilliant, complex, and very formal. *The Mills of the Kavanaughs* (1951) gave more personal expression to his themes by using the dramatic monologue. He adopted an offhand and autobiographical style in such works as *Life Studies* (1959), *For the Union Dead* (1964), and *Day by Day* (1977). The collection *History* (1973) contains the poet's reflections on world events. Lowell was also an award-winning translator and wrote three plays about early United States history. These plays were published under the title *The Old Glory* (1965). His *Collected Prose* was published in 1987, after his death.

Robert Traill Spence Lowell, Jr., was born in Boston. He was a conscientious objector during World War II and was active in antiwar movements during the 1960's.
Bonnie Costello

Lowlands. See Scotland (The land).

Lowry, Lois (1937-), is an American author whose fiction for young adults explores serious issues. She won the 1990 and 1994 Newbery medals for *Number the Stars* (1989) and *The Giver* (1993). In *Number the Stars,* Lowry describes the experiences of a Danish family who shelter a Jewish girl from Nazi invaders during World War II (1939-1945). *The Giver* is set in a country in the future where everyone except a "keeper of memories" remembers only happy events. The novel is a chilling portrait of a future world in which some people are allowed to decide the fate of all others and no one celebrates traditional holidays or family gatherings.

Lowry began her career writing about youngsters who face serious challenges, such as a death in the family, adoption, and moving. *A Summer to Die* (1977), her first novel, established Lowry as an important author of young adult fiction. She has also written a humorous series about a rebellious girl named Anastasia Krupnik, beginning with *Anastasia Krupnik* (1979). Lowry was born in Honolulu, Hawaii. Jill P. May

Lowry, *LOWR ee,* **Malcolm,** *MAL cuhm* (1909-1957), was an English author best known for his novel *Under the Volcano* (1947). In that novel, Lowry created a complex psychological and symbolic study of a disturbed mind. The story takes place on the last day in the life of Geoffrey Firmin, a former British diplomat living in Mexico, who has become a hopeless alcoholic.

Clarence Malcolm Lowry was born in New Brighton, near Birkenhead, England. Lowry wrote *Ultramarine* (1933), a fictional account of a sea voyage he took as a young man. He did much of his writing from 1939 to 1954 while living in Canada. Lowry left considerable unpublished material when he died. Some of it was published after his death, including a book of related short stories, *Hear Us O Lord from Heaven Thy Dwelling Place* (1961); *Selected Poems* (1962); and *Selected Letters* (1965). Laurie R. Ricou

Loyal Order of Moose. See Moose International, Inc.

Loyalists. See Revolutionary War in America; United Empire Loyalists.

Loyola, *loy OH luh,* **Saint Ignatius,** *ihg NAY shuhs* (1491-1556), was a Roman Catholic religious leader who founded the Society of Jesus. Members of this religious order of men are known as Jesuits.

Ignatius was born into an aristocratic Basque family near Azpeitia, Spain. His real name was Iñigo de Loyola. In 1517, Ignatius became a courtier of the Duke of Nájera. While fighting the French at Pamplona in 1521, Ignatius suffered severe wounds. During his long period of recovery, he read a book about the life of Jesus and stories about the saints. These books convinced him that he should abandon his life of ambition and pleasure. After his recovery, he went to the Benedictine mon-

astery of Montserrat, near Barcelona. There, he hung up his sword at the altar of the Virgin Mary and dedicated himself to a spiritual life.

During much of 1522 and 1523, Ignatius lived in a cave near Manresá, where he prayed and subjected himself to many physical discomforts. He also underwent mystical experiences. Ignatius drew on these mystical experiences in his *Spiritual Exercises,* a manual of self-discipline and prayer. He wrote *Spiritual Exercises* between 1522 and 1541, and it was published in 1548.

To prepare for the priesthood, Ignatius studied humanities and theology in Paris from 1528 to 1535. In 1534, he and six other men formed the Society of Jesus. They took vows of poverty and chastity.

Ignatius was ordained a priest in 1537. He and the other Jesuits then went to Rome to offer their services to the pope. On the way, Ignatius had a vision at the shrine of La Storta, near Rome. In the vision, God told Jesus, "I desire you to take this man for your servant." Then Jesus said to Ignatius, "I will be favorable to you in Rome." Pope Paul III approved the Society of Jesus in 1540. Ignatius became its first *superior general* (head). He also wrote the order's constitutions, which established the Jesuits' organization and way of life.

Under the leadership of Ignatius, the Jesuits helped reform the church during a self-renewal movement called the Counter Reformation (see **Roman Catholic Church** [The Counter Reformation]). They also promoted religious education and preached the Gospel in Asia and the New World. Ignatius regarded himself as divinely chosen to lay the foundation for all these undertakings. He was *canonized* (declared a saint) in 1622. His feast day is July 31. John Patrick Donnelly

See also **Jesuits; Xavier, Saint Francis.**

LPG. See **Butane and propane; Gas** (Gas in the home).

LSD is an extremely powerful drug that causes distortions in thinking and feeling. These distortions include *hallucinations,* during which a person sees, hears, smells, or feels things that do not really exist. A dose of only 100- to 200-millionths of a gram of LSD can produce a mental and emotional experience called a *trip* that lasts from 8 to 12 hours. Most scientists believe that people who use LSD do not become physically dependent on the drug.

The letters *LSD* stand for *lysergic acid diethylamide.* LSD is made from *ergot,* a fungus that grows on rye and wheat. Two Swiss chemists, Arthur Stoll and Albert Hofmann, first made LSD in 1938. In 1943, Hofmann accidentally swallowed a small amount of LSD and discovered the drug's hallucinatory effects.

The effects of LSD can seem either pleasant or frightening. The drug may give users the feeling that they are gaining new insights into their personality and past experiences. LSD also makes individuals anxious, confused, or terrified. The user may panic and require medication to overcome the effects of LSD. Some scientists believe the drug can cause birth defects in the babies of women who take LSD during pregnancy.

A person who takes LSD may see shifting patterns of light and "hear" colors. The sensory reactions become exaggerated and moods may alter rapidly from intense happiness to deep depression. A user of LSD may experience a *flashback* when not under the influence of the drug. During a flashback, a person relives a frightening trip that occurred weeks or months before. The person may also become anxious or depressed and fear losing his or her mind. The number of deaths caused directly by LSD are unknown. However, accidents and suicides have occurred as the result of "bad trips."

The United States prohibits the possession, distribution, or sale of LSD except for research approved by the Department of Justice. Different states have various laws covering control of the drug. Donald J. Wolk

See also **Hallucinogenic drug.**

Luanda, *loo AHN duh* (pop. 1,200,000), is the capital and largest city of Angola, and the country's chief industrial center and port. It lies on the west coast of Africa, along the Atlantic Ocean (see **Angola** [map]). Its industrial facilities include foundries; sawmills; textile mills; and cement, printing, and food-processing plants. An airport and a railroad serve the city.

The Portuguese established a colony in Angola in 1575 and founded Luanda in 1576. The city became the main center of Portuguese settlement in Angola. The Portuguese built many impressive European-style structures in Luanda, including a fortress, churches, libraries, government buildings, and apartment buildings. Rundown areas called *shantytowns* lie outside the city.

Angola gained its independence from Portugal in 1975. Civil war broke out after Angola became independent, and most of the Portuguese left. Today, the majority of Luanda's people are black Africans.

Gerald J. Bender

Luba, *LOO buh,* are an important ethnic group in the African country of Congo (Kinshasa). About 3 million Luba live in Congo. Most live in the grasslands of the central and southeastern parts of the country. The Luba consist of two main groups—the Luba-Kasai and the Luba-Shaba.

Most of the Luba-Kasai live in cities and towns. They are familiar with Western culture, and many hold high posts in government, industry, and trade. Most of the Luba-Shaba live in small rural villages and work as farmers. They grow cassava, corn, millet, and other crops. Luba farmers prepare the land for planting by burning away the grasses and using the ash as fertilizer.

The Luba speak a language called Tshiluba, which belongs to the Bantu family of African languages. The traditional Luba religion recognizes a supreme being as well as lesser gods and the spirits of ancestors. Luba woodcarvers are world famous for beautiful masks and statues that honor the memory of their ancestors.

The Luba descended from Bantu-speaking peoples who probably came to central Africa about 2,000 years ago. By 1700, a number of Luba-Shaba groups had united to form the Luba Empire. They developed a powerful army that conquered many neighboring peoples. The Luba also established a prosperous trade in such goods as copper, iron tools, and salt. The empire collapsed in the late 1800's after it was invaded by African, Arab, and Portuguese slave traders.

During the early 1900's, many Luba-Kasai began to move from rural to urban areas and to adopt numerous aspects of Western culture. Many others took jobs in copper mines in southern Congo. In the early 1960's, the competition for jobs and for political influence led to outbreaks of violence in several cities between the Luba-Kasai and other ethnic groups. Thomas Q. Reefe

Lubbock, *LUHB uhk,* Texas (pop. 199,564; met. area pop. 242,628), is the world's leading manufacturer of cottonseed products. The city is a major United States cotton market and an industrial center of Texas. It is a trade and transportation center of the High Plains, a thriving farm region of northwest Texas, and is often called the *Hub of the High Plains* (see **Texas** [political map]).

Description. Lubbock, the county seat of Lubbock County, covers about 115 square miles (298 square kilometers). The Lubbock metropolitan area occupies about 901 square miles (2,334 square kilometers).

Cotton markets in Lubbock handle about 1 billion pounds (450 million kilograms) of cotton annually. The city also has about 260 manufacturing plants. Lubbock produces about 1 $\frac{1}{2}$ billion pounds (680 million kilograms) of cottonseed oil yearly. Other industries include meat packing, winemaking, and the manufacture of farm equipment and other nonelectrical machinery. Lubbock is an important cattle-feeding center. Two railroad freight lines and seven major highways serve the city. Lubbock International Airport lies outside Lubbock.

Lubbock is the home of Lubbock Christian University and Texas Tech University. The Texas Tech Museum in the city features an exhibit of historic ranch buildings. The Lubbock Symphony Orchestra performs in the Lubbock Memorial Civic Center.

History. Comanche Indians lived in what is now the Lubbock area when whites first arrived there. During the 1880's, settlers established cattle ranches in the area. In 1890, land developers founded two villages near what is now Lubbock. The next year, the developers moved the buildings of both villages to a single site where two small rivers meet. They named the resulting town Lubbock in honor of Lieutenant Colonel Thomas S. Lubbock of the Confederate Army. It was incorporated in 1909.

In the 1920's, landowners in the area converted many ranches to cotton farms. As a result, Lubbock became a center of cotton marketing. After Texas Tech University opened in 1925, the city became an educational center. The 1950's brought rapid industrial growth to the area.

In 1970, a tornado struck Lubbock. A ruined area of downtown Lubbock became the site of an urban renewal project called the Lubbock Memorial Civic Center. The center, completed in 1977, includes a theater and facilities for conventions and exhibitions. Lubbock has a council-manager form of government. R. M. Sanders

Lübeck, *LOO behk* (pop. 210,318), is the most important German port serving shipping on the Baltic Sea. The city lies in Germany on the Trave River, which empties into the Baltic (see **Germany** [political map]). Lübeck is a center of machine manufacturing and shipbuilding. It is also known for its *marzipan* (almond and sugar candy) products. It has a number of medieval buildings, including its old town hall and its cathedral.

A natural harbor made Lübeck an important trading point from the time it was founded in 1143. In 1226, the city became a self-governing *imperial free city* (see **Free city**). Lübeck was leader of the *Hanseatic League,* a commercial union of north German cities that grew out of trade associations that had begun to develop in the late 1100's. By 1669, when the last meeting of the league's *diet* (assembly) was held, Lübeck had lost much of its importance. See **Hanseatic League.** Completion of the Elbe-Trave Canal in 1900 reestablished Lübeck as an important port by connecting it to the Elbe River, one of Europe's busiest waterways. Peter H. Merkl

Lubitsch, *LOO bihch,* **Ernst** (1892-1947), a German-born film director and producer, became famous for his comedies and farces. His films are characterized by clever filming devices and ironic insights into human behavior, especially the battle between the sexes.

Lubitsch was born on Jan. 28, 1892, in Berlin. He gained fame as the director of *Gypsy Blood* (1918), *Passion* (1919), and other historical spectacles. He arrived in Hollywood in 1923 and surprised everyone by turning to witty, sophisticated comedy of manners. His major comedies include *Trouble in Paradise* (1932); *Ninotchka* (1939), starring Greta Garbo; and his satire on war, *To Be or Not to Be* (1942). Musicals, such as *The Love Parade* (1929) and *The Merry Widow* (1934), exemplified his creative use of sound. Gene D. Phillips

Lucas, George (1944-), is an American motion-picture producer, director, and writer. He wrote and directed the science-fiction fantasy *Star Wars* (1977). The film became an international success because of its creative special effects, appealing characters, and suspenseful story of good versus evil. Lucas produced two sequels to *Star Wars.* They were *The Empire Strikes Back* (1980) and *Return of the Jedi* (1983). Lucas later announced he would make three "prequels" that deal with events leading up to the *Star Wars* story. Two of the films have been made so far. They are *Star Wars: Episode 1–The Phantom Menace* (1999) and *Star Wars: Episode II–Attack of the Clones* (2002).

Lucas produced the popular movies *Raiders of the Lost Ark* (1981) and *Indiana Jones and the Temple of Doom* (1984), and was an executive producer for *Indiana Jones and the Last Crusade* (1989). All three were directed by his friend Steven Spielberg. The films reflect the love both men feel for the action-packed adventure movies of their youth. Lucas is the founder and chairman of LucasArts Entertainment Co. This company includes Industrial Light & Magic (ILM), a company that creates special visual effects for motion pictures. Other divisions of LucasArts produce computer game programs.

Lucas was born on May 14, 1944, in Modesto, California. He won a national student film competition in 1967 for his short film *Electronic Labyrinth: THX 1138-4EB.* He was coauthor and director of a feature-length version of the work, *THX 1138* (1971). Lucas also served as coauthor and director of *American Graffiti* (1973). This film reflects his own high school years. Gene D. Phillips

Luce, *loos,* **Clare Boothe** (1903-1987), became famous for her activities in American politics and government. She was also a noted playwright. Luce served in the United States House of Representatives from 1943 to 1947 as a Republican from Connecticut. She was the U.S. ambassador to Italy from 1953 to 1956. Luce became one of the first women to represent the United States in a major diplomatic post. She was appointed ambassador to Brazil in 1959, but resigned after winning Senate approval because several senators questioned her ability.

Luce's plays are noted for their sharp dialogue and sarcastic characterizations. Her most successful play, *The Women* (1936), satirizes rich, idle American women. Luce's other plays include *Abide with Me* (1935), *Kiss the Boys Good-bye* (1938), and *Margin for Error* (1939).

Clare Boothe was born in New York City. She worked

as a magazine editor and journalist from 1929 to 1934. In 1935, she married Henry R. Luce, the founder of *Time* and *Life* magazines. After converting to Roman Catholicism in 1946, Clare Boothe Luce wrote several articles on religious subjects. She died on Oct. 9, 1987.

John B. Vickery

Luce, *loos,* **Henry Robinson** (1898-1967), was a noted American publisher and editor. *Time,* his weekly newsmagazine, added new words and introduced writing twists to the American language. *Life,* a pictorial magazine begun by Luce, had many imitators.

Luce and his friend Briton Hadden founded *Time* magazine in 1923, and in 1930 Luce started *Fortune,* a business periodical. His radio program *March of Time* began in 1931, and a newsreel series of the same name began in 1935. Both were abandoned in 1953. Luce purchased *Architectural Forum* in 1932 and began publishing *Life* as a weekly in 1936. He launched another periodical, *House and Home,* in 1952. In 1964, the publishing rights to *Architectural Forum* were given away and *House and Home* was sold. *Life* originally ceased publication in 1972. It was published as a monthly from 1978 to 2000. The first issue of Luce's magazine *Sports Illustrated* appeared in 1954.

Henry Robinson Luce was born on April 3, 1898, in Dengzhou (now Penglai), China. He was the son of Presbyterian missionaries. Luce graduated from Yale University. He died on Feb. 28, 1967. His wife, Clare Boothe Luce, gained fame as a politician, diplomat, and playwright (see **Luce, Clare Boothe**). Joseph P. McKerns

Lucerne, *loo SURN* (pop. 61,034; met. area pop. 177,734), is a tourist center and historic city in central Switzerland. The German name of the city is *Luzern.* Lucerne lies on the western shore of the Lake of Lucerne and on the banks of the Reuss River. For location, see **Switzerland** (political map).

Lucerne is the capital of the *canton* (state) of Lucerne. The city's location along the lake and near magnificent mountains attracts thousands of visitors each year. Other attractions in Lucerne include medieval houses, the covered Chapel Bridge, an annual music festival, and the Swiss Transport Museum and other museums. In addition, the famous Lion of Lucerne monument in the city honors Swiss soldiers who were killed while serving the king of France during the French Revolution (1789-1799).

Lucerne dates from the early 700's. In 1332, it became the first town to enter into an alliance with the peasants of central Switzerland. This action was an important step in the growth of a political alliance called the Swiss Confederation. Heinz K. Meier

Lucerne. See **Alfalfa.**

Lucerne, Lake of. See **Lake of Lucerne.**

Lucid, Shannon Wells (1943-), a United States astronaut and biochemist, set the world record for time in space by a woman and the record for an American of either sex. In 1996, she spent 188 days in space, mostly aboard the Russian space station Mir.

Lucid traveled to and from the space station aboard the space shuttle Atlantis. On Mir, she conducted science experiments. She studied how apparent weightlessness in orbit affects living tissue and the growth of protein crystals.

Shannon Wells was born on Jan. 14, 1943, to missionary parents in Shanghai, China, and grew up in Oklahoma. She married Michael F. Lucid, an oil company executive, in 1968. She received a Ph.D. degree in biochemistry from the University of Oklahoma in 1973.



NASA

Shannon Wells Lucid

Lucid worked as a research scientist until 1978, when she was admitted to the astronaut program. From 1985 to 1993, she made four shuttle flights, during which she performed medical experiments. She also deployed satellites and the Galileo space probe to Jupiter. Lucid spent a year preparing for the Mir mission at a training center near Moscow.

James Oberg

Lucifer, *LOO suh fuhr,* is a name commonly used for the devil. It was originally a Latin word meaning *light bearer.* The word comes from a Latin translation of a Hebrew term from Isaiah, which means *shining one.* It appears in Isaiah 14:12: "How you have fallen from the heavens, O shining one, son of morning!"

Isaiah applied the name Shining One or Lucifer to a king of Babylon. But it came to be thought of as an evil archangel who was hurled from heaven for his wickedness and revolt against God. The word *Lucifer* also refers to the planet Venus as the morning star.

Joseph M. Hallman

Luck. See **Superstition.**

Lucknow (pop. 2,207,340) is a city in north-central India. It serves as the capital of the state of Uttar Pradesh. For location, see **India** (political map).

Lucknow stands along the Gomati River. The minarets and gilded cupolas of the city present a striking appearance from a distance. An old commercial district is in the northwest part of Lucknow. The area has many silversmith shops and the stores of other handicraft workers. Modern offices and shops lie southeast of the old commercial district. Lucknow's products include aircraft engines and other aircraft equipment; cotton fabrics; embroidery; and silver, gold, and brass wares. Mangoes and melons are grown in surrounding rural areas.

Muslims built a fort on the site of Lucknow in the 1200's. The area became part of the British Empire in 1856. Indian soldiers seized Lucknow in 1857, during the Indian Rebellion. However, British forces recaptured the city in 1858. In 1947, Lucknow and the rest of India gained independence from the United Kingdom.

P. P. Karan

See also **Indian Rebellion.**

Lucretius, *loo KREE shih uhs* or *loo KREE shuhs* (99?-55? B.C.), was a Roman poet and philosopher. His only surviving work is a philosophical and scientific poem called *De rerum natura (On the Nature of Things).* Lucretius wrote the poem to free humanity from religious superstition and the fear of death. The poem's emotional power and vivid language help to make it a masterpiece of Latin literature.

Lucretius was inspired by the teachings of the Greek philosopher Epicurus in writing *De rerum natura.* The poem reflects the Epicurean ideals of a tranquil mind

and freedom from irrational fear. It argues that people need not fear a life after death, because the soul—like everything else—is a cluster of atoms and therefore disperses after death. The poem also argues that people should not fear the gods, because the gods remain aloof from human affairs. The poem gives rational explanations for earthquakes, thunder, and other phenomena that might be feared as supernatural events.

Lucretius's full name was Titus Lucretius Carus. According to one story, Lucretius went mad after taking a love potion. He wrote poetry during brief periods of sanity, and eventually killed himself. Scholars cannot verify this story, but Lucretius's poem does bitterly denounce the passions of love. W. W. Bartley III

See also **Atomism; Epicurus.**

Ludendorff, *LOO duhn dawrf,* **Erich Friedrich Wilhelm,** *AY rihkh FREE drihkh VIHL hehlm* (1865-1937), a German general, served as chief of staff to Paul von Hindenburg during World War I (1914-1918). Ludendorff's help in organization and planning resulted, historians believe, in many victories for Germany.

During World War I, Ludendorff rose from the rank of chief quartermaster of the Second Army to chief of staff of the entire German Army. After the collapse of the German Army in 1918, Ludendorff fled to Sweden. He returned in 1919 to enter politics and aligned himself with the Nazis.

Ludendorff took part in the unsuccessful Beer Hall Putsch, a revolution organized by Adolf Hitler, in Munich in 1923. He went to trial along with Hitler but was freed because of his war record. Later, Ludendorff broke with Hitler. He became a believer in a pagan religion that worshiped the old German god Wotan.

Ludendorff was born near Posen, Germany (now Poznań, Poland). He received a military education.
Gabriel A. Almond

Ludington, Sybil (1761-1839), was a heroine of the Revolutionary War in America (1775-1783). At the age of 16, she made a courageous ride on horseback to assemble American troops for a fight against the British at Danbury, Connecticut.

Sybil Ludington was born and raised in Putnam County, New York. Her father, Colonel Henry Ludington, commanded a military regiment there. On April 26, 1777, a messenger brought news that the British were attacking nearby Danbury, where the local patriots stored their military supplies. The messenger had arrived exhausted, and so Sybil volunteered to round up her father's regiment. She rode through the night and covered nearly 40 miles (64 kilometers). The British looted and burned Danbury. However, they later suffered about 200 casualties in a battle that included the troops Sybil had gathered. William Morgan Fowler, Jr.

Ludwig II (1845-1886), king of Bavaria, became known for constructing elaborate palaces and other buildings. His taste for extravagant structures and his eccentric behavior earned him the name "Mad Ludwig."

Ludwig was born in Munich. He began to reign as king in 1864. However, Bavaria was governed almost entirely by government ministers and the Bavarian parliament. This system, which had been established before Ludwig became king, allowed him to pursue his hobbies full-time.

Ludwig spent his family fortune and part of the Bavarian treasury on building Linderhof Palace, Herrenchiemsee Palace, and Neuschwanstein Castle. Neuschwanstein Castle later became the model for castles in Walt Disney Company theme parks. Ludwig became the patron of German composer Richard Wagner and built him an elaborate performance hall in Bayreuth, Germany.

In 1886, the Bavarian government deposed Ludwig because of his overspending and his eccentric behavior. He was then sent to Berg Castle. The day after he arrived, Ludwig and his physician were found drowned in a nearby lake. Otis C. Mitchell

See also **Germany** (picture: Neuschwanstein Castle).

Luftwaffe, *LUFT VAHF uh,* has been the name of the German Air Force since 1935. The word means *air weapon.* Reich Marshal Hermann Goering commanded the Luftwaffe during World War II (1939-1945). He succeeded in making it a separate force equal in status to the army and navy. The Luftwaffe effectively supported German ground forces in Poland, Norway, France, Crete, and the Soviet Union. But it failed to win the critical Battle of Britain. See also **Air Force** (World War II); **Goering, Hermann Wilhelm.** Charles B. MacDonald

Luge, *loozh,* is a winter sport in which one or two people lie on their back on a sled and race feet first down an ice-covered course. The sled with the fastest combined time over a number of runs wins the competition. *Luge* is the French word for a small sled.

A luge sled has two wooden or fiberglass runners with steel blades. The sled is about 4 feet (1.2 meters) long, 20 inches (51 centimeters) wide, and 8 inches (20 centimeters) high. One-person sleds can weigh up to 22 kilograms (49 pounds). Two-person sleds can weigh up to 25 kilograms (55 pounds). The driver lies on an aerodynamically shaped fiberglass seat. He or she steers by pressing in on the runners with the legs and pressing down on the sled with the shoulders. Luge sleds have been clocked at over 90 miles (145 kilometers) per hour.

Critically reviewed by the United States Luge Association

See also **Olympic Games** (table).



Fred Zimny, USA Luge

Luge is a winter sport in which one or two competitors race on a sled down an ice-covered course at a high rate of speed. Competitors lie on their back and race feet first.

Lugworm is a small sea worm with a soft body. It is also called *lobworm* or *lugbait*. Deep-sea fishing enthusiasts often use this worm for bait. Lugworms live along the Atlantic coasts of North America and Europe and around the Mediterranean Sea. They live underwater, in burrows dug into the sand. During low tide, the burrows may be exposed. The lugworm's body is from 5 to 8 inches (13 to 20 centimeters) long, and it is made up of rings or segments. The front end of the body is thicker than the hind end and is covered with bristles. The lugworm breathes with 13 pairs of gills. David F. Oetinger

Scientific classification. Lugworms are in the class Polychaeta, the phylum Annelida, and the family Arenicolidae.

Luisetti, Hank (1916-), an American basketball player, revolutionized the game with his one-handed jump shot. Previously, players had used a two-handed set shot. Luisetti learned the new shot from Tommy DeNike, his high school basketball coach, and perfected it while playing at Stanford University. In 1936, Luisetti introduced the shot to Eastern fans in a famous Stanford victory that ended a 43-game winning streak of Long Island University. His shot increased the scoring and action in basketball, and countless players adopted it.

Angelo Enrico Luisetti was born on June 16, 1916, in San Francisco. At Stanford, the 6-foot 2-inch (188-centimeter) forward broke the national college four-year scoring record with 1,596 points. In 1938, he scored 50 points against Duquesne University. He was the first basketball player to score that many points in one game.
Bob Logan

Lujan, *LOO hahn,* **Manuel, Jr.** (1928-), was United States secretary of the interior from 1989 to 1993 under President George H. W. Bush. He was the first Hispanic American to head the U.S. Department of the Interior.

From 1969 until January 1989, Lujan had served in the U.S. House of Representatives as a Republican from New Mexico. In the House, he became the leading Republican member of the Interior and Insular Affairs Committee and the Committee on Science, Space, and Technology. Lujan was born on May 12, 1928, in San Ildefonso, New Mexico. Guy Halverson

Luke, Saint, was an early Christian who was a friend of Saint Paul. Little is known about Luke. He is mentioned only three times in the New Testament. Paul described Luke as a "beloved physician" (Colossians 4:14).

Tradition identifies Luke as the author of the third Gospel and its companion volume, the Acts of the Apostles. Luke's life and career have been reconstructed using this material. Later tradition reports that he taught in Alexandria, Rome, and Greece, and died in Asia Minor. Although modern scholars agree that the same person wrote the third Gospel and Acts, most of these scholars do not consider Luke the author. Luke's feast day is celebrated on October 18. Richard A. Edwards

See also **Acts of the Apostles; Bible** (Books of the New Testament); **Gospels.**

Luks, George Benjamin (1867-1933), was an American painter and illustrator. He became a member of the group of realistic painters called *The Eight* (later called the *Ashcan School*). Luks's lusty paintings of life in the streets reflect the spontaneous, honest approach to painting that characterizes the spirit of The Eight.

Luks was born on Aug. 13, 1867, in Williamsport, Pennsylvania. He studied painting in Philadelphia and Europe, and began his career as a newspaper illustrator and cartoonist in Philadelphia. From 1896 to 1902, he drew Sunday newspaper comics for the *New York World*. After 1902, he turned to painting, chiefly in New York City. He died on Oct. 29, 1933. Charles C. Eldredge

See also **Ashcan School; Henri, Robert.**

Lully, *loo LEE,* **Jean-Baptiste,** *zhahn bah TEEST* (1632-1687), an Italian-born composer, wrote the first significant French operas. Lully was born on Nov. 29, 1632, in Florence. He was brought to France in 1646. He became a clever courtier and rose to a position of influence in the court of King Louis XIV. Lully formed a highly disciplined band of string players, *Les Petits Violons,* whose playing became a model of French musical style. By 1662, he stood unopposed as the king's favorite musician. Eventually, he had a virtual dictatorship over the production, staging, and musical direction of the court opera. His best-known operas include *Cadmus and Hermione* (1673), *Bellerophon* (1679), *Amadis* (1684), *Roland* (1685), and *Armide* (1686).

The *arias* (solos) and *recitatives* (narrative sections) of Lully's operas have a rhythmic style suited to the rhythm of French language. Lully also composed music for many ballets. He established the French overture, with its slow beginning, faster second section, and often a final return to the slow tempo. His music influenced the composers Jean Philippe Rameau, Johann Sebastian Bach, and George Frideric Handel. Darrell Matthews Berg

See also **Opera** (French opera); **Overture.**

Lumbee Indians are the largest Indian tribe in the United States east of the Mississippi River. According to the 2000 U.S. census, there are about 52,000 Lumbee. Most of the Lumbee live in and near Robeson County in southeastern North Carolina.

Most historians agree that the Lumbee are a mixture of peoples, but scholars have several theories about their exact origin. According to one theory, the Lumbee are descendants of the Hatteras tribe and of English colonists who settled on Roanoke Island in 1587. This island lies off the coast of North Carolina. The settlement there came to be called the *Lost Colony* because it disappeared mysteriously, but the people may simply have joined the Indians. Many Lumbee have the same last names as the missing colonists (see **Lost Colony**). Other theories trace the Lumbee ancestry to the Cherokee, the Tuscarora, or an eastern band of the Sioux.

During the 1800's, the Lumbee were called the *Croatan.* Early records tell that they looked like Indians but lived like white settlers. The federal government classified them as different from the Indians on reservations. In the 1880's, North Carolina gave the Croatan separate legal status, including the right to have their own schools. They opened their first school, the Croatan Normal School, in Pembroke, North Carolina, in 1887. This school is now Pembroke State University.

In 1953, the North Carolina legislature voted that the Indians in and near Robeson County be known as the Lumbee Indians. The name comes from the Lumbee (now the Lumber) River, which flows through the county. In 1956, Congress declared the Lumbee a tribe but did not make them eligible for government Indian benefits.

Today, the Lumbee are the nation's largest group of Indians without a reservation. Many of them farm the land for a living. Adolph L. Dial



Weyerhaeuser Company

A large log is cut into lumber at a sawmill. The log, mounted on a moving platform called a *carriage,* travels back and forth past a large *headsaw.* The headsaw slices a piece of lumber from the log each time the carriage goes by.

Lumber includes boards and larger pieces of wood that have been sawed from logs. Almost every house uses at least some lumber in its construction. Lumber furnishes material for framing, flooring, siding, woodwork, doors, and other building parts. About half the lumber in the United States is used by the construction industry. About one fourth is used in building remodeling and repair. The rest goes from sawmills to factories that make boxes, crates, furniture, tool handles, toys, and hundreds of other products.

Every time a piece of wood is cut at a sawmill, sawdust and small chips of wood are also produced. These leftover bits of wood can be made into many valuable products. Often mills send wood scraps and small logs through a chipper. Pulp mills grind the chips or treat them with chemicals to change them into wood pulp. Manufacturers use pulp to make paper, hardboard, plastics, rayon, and other products. Sawdust and bark are often used for fuel. For a description of the products obtained from trees, see **Forest products.**

The lumber industry employs thousands of people to harvest trees, transport logs to mills, saw logs into lumber, and sell the lumber. The United States uses a total of more than 50 billion board feet (120 million cubic meters) of lumber every year—more than any other country. The United States also leads the world in lumber production.

Kinds of lumber

Lumber is divided into two main classes: *softwood* and *hardwood.* These classes are not based on the softness or hardness of the wood. Rather, they refer to the kind of tree from which the lumber came. Some softwood lumber is harder and heavier than many hardwoods. Also, some hardwood lumber is softer than lumber from many softwood trees. In addition, the term *lumber* is sometimes used to describe wood boards and timbers made by gluing together smaller pieces of wood. This kind of lumber is called *composite lumber.*

Lumber is also classed by its condition. *Rough lumber* has straight sides and edges but is rough and splintery. *Dressed lumber* comes in smooth, evenly cut boards. *Worked lumber* is dressed lumber that has a design cut in it for decoration or to make boards fit together.

Softwood lumber comes from trees called *conifers.* The word *conifer* refers to the cones in which the seeds of most softwood trees develop (see **Conifer**). Common conifers include pines and firs. These trees have thin, waxy, needle-shaped or scalelike leaves. They are also called *evergreens.* Pines, Douglas-fir, Western true firs, hemlock, redwood, spruce, and cedars produce most softwood lumber. Their wood is used for wall, floor, and roof supports; door and window frames; other building materials; and boxes.

Softwood lumber can be classified according to its use. Carpenters use *framing lumber* to build houses. *Structural lumber* can stand heavy strain. It is used for posts, planks, joists, and beams. Sawmills usually sell *factory and shop lumber* directly to factories for making boxes, spools, and other products.

Hardwood lumber is sawed from broad-leaved trees. These trees are usually *deciduous,* which means they lose their leaves in autumn (see **Deciduous tree**). Hardwoods used for lumber include oak, ash, elm, hickory, maple, tulip tree, sweet gum, birch, tupelo, cottonwood, aspen, walnut, cherry, and beech. Hardwoods are used in making furniture, cabinets, paneling, flooring, and trim. They are also used for such items as baseball bats and tool handles.

Much hardwood lumber is sawed into small pieces called *hardwood dimension parts.* This cuts out defects and increases the lumber's usefulness. Manufacturers use hardwood dimension to make chair arms, piano legs, and other furniture parts. When furniture or tool factories want plain blocks of hardwood, they order *rough hardwood dimension.* Trimmed, molded, or sanded wood is *surfaced hardwood dimension.* If manufacturers want parts of a chair, such as legs, arms, or

seats, ready to be assembled, they order *finished market products.*

Composite lumber is made by gluing together a number of *veneers*—long, paper-thin strips of wood—under high pressure. In this way, large pieces of lumber can be made from small-sized trees. *Plywood* is a composite wood.

From forest to sawmill

Since the early days of colonial life in North America, lumbering has been an important industry. *Lumberjacks,* who cut down trees and delivered logs to the mills, became famous as strong, hearty, courageous workers. Many legends sprang up about their exploits as they cleared forests and took logs to the mill by ox team, by raft, or by guiding them down rushing streams after spring thaws. See **Bunyan, Paul.**

The life of a logger. Lumberjacks must have strength, courage, and be highly skilled in their work. Large-scale lumbering operations require special mechanical equipment and technical knowledge.

Before the 1900's, loggers lived in large bunkhouses in logging camps where there were few comforts. Today, most loggers live in their own homes. They live in a logging camp only if the logging site lies in a hard-to-reach place, for example in a rugged mountain area. Only a few logging camps exist in the United States today. But modernized camps are still being used in the forests of Canada. The modern camp has comfortable facilities for eating, sleeping, and recreation. Some camps have private houses for families.

Lumber terms

Board foot is a piece of lumber 1 foot (30 centimeters) long, 1 foot wide, and 1 inch (2.5 centimeters) thick. It equals 0.083 cubic foot (0.0024 cubic meter).
Flooring is lumber used in floors. It is usually hardwood 1 inch (2.5 centimeters) thick and 2 to 4 inches (5 to 10 centimeters) wide.
Framing lumber is lumber used for houses and buildings.
Hardwood dimension parts are usually short, narrow pieces of hardwood that have no knots or defects.
Landing is a central place in the forest where logs are brought before being taken to a sawmill.
Log rule is a table that shows about how much lumber can be sawed from logs of different sizes.
Lumberjack, or logger, is a worker who cuts down trees, saws them into logs, and brings them to the mill.
Millwork is material made of finished wood in millwork plants or planing mills. It includes doors, blinds, frames, cornices, columns, mantels, and panelwork.
Paneling is lumber made into panels, especially for the insides of buildings.
Plank is a piece of lumber 2 to 4 inches (5 to 10 centimeters) thick and 4 or more inches wide.
Plywood is a panel made of thin layers of wood glued together under heavy pressure.
Sawmill is a plant that saws logs into lumber.
Sawtimber means trees large enough to be cut for lumber.
Siding is lumber used to cover the outsides of buildings.
Skid road is a road or trail leading from a cutting area to the skidway or landing.
Skidding means hauling or dragging logs from the cutting area to the landing.
Slabs are outer pieces of a log removed in sawing lumber.
Softwood dimension lumber is softwood lumber from 2 to 4 inches (5 to 10 centimeters) thick and more than 2 inches wide. It includes frames, joists, planks, and rafters.

Cutting down trees. Before the loggers go into the woods, a *forester* decides which trees they should cut. The forester is a scientist trained in managing forests for a variety of purposes. The forester tries to grow crops of trees so that they will yield the greatest possible amount of lumber. He or she also knows how to protect forests from fire, insects, disease, and grazing animals. See **Forestry.**

Loggers called *fallers* come to work carrying their own power saws. They *fell,* or cut down, trees that the forester has marked for cutting. The power saw that the fallers use may weigh as much as 40 pounds (18 kilograms). With its small gasoline motor and whirling chain saw, it can slice through a tree trunk in a few seconds.

In felling a large tree, the faller first makes an *undercut.* A wedge-shaped piece is cut out of the tree trunk with an ax or power saw. The faller makes the undercut on the side of the tree that is to fall toward the ground. The cut is made close to the ground to avoid wasting valuable wood by leaving a high stump. After the saw has cut through the tree trunk, the undercut makes the tree lose its balance and fall toward that side. Expert fallers can drop a tree exactly where they want it. They can avoid striking other trees, or hitting stumps that might break or damage the trunk of the falling tree.

After a tree has been felled, workers called *buckers* cut the trunks into shorter lengths, so that they can take them out of the forest more easily. Buckers use axes or power saws to lop off the limbs. Then they saw the trunks into logs from 8 to 40 feet (2.4 to 12 meters) long.

Since the mid-1900's, large modern machines have simplified the work of loggers. For example, hydraulic *tree shears* quickly cut through a tree like giant scissors. The tree shears are built into tractors that move from tree to tree. Other machines do more than one job. Some *tree harvesters* can fell a tree, remove its branches, cut it into logs, and sort the logs in bunches.

Transporting logs from the woods to the sawmill is the second step in logging. It consists of two operations. First, the loggers *skid* (drag or haul) the logs to the *landing* (a central place in the woods). Then they transport the logs from the landing to the sawmill.

Workers use special tractors called *skidders* or long cables called *draglines* to skid the logs to the landing. Special carriers, such as hot-air balloons or helicopters, may be used where the ground is steep or the harvest area difficult to reach.

A system called *high-lead* (pronounced *leed*) *logging* uses pulleys and steel cables to drag logs up steep slopes or to swing them across ravines. The pulleys and cables are supported by portable towers and are powered by giant diesel, steam, or electric winches. The cables pick up only one end of the log. The other end may drag along the ground. High-lead logging can bring logs to a landing as far away as 800 to 1,500 feet (240 to 460 meters). Other cable-logging systems can carry logs 2,500 feet (760 meters) or more. Such systems use cables called *skylines.* Skylines pick up the entire log instead of dragging one end over the ground. Logging with skylines does less damage to the forest floor than high-lead logging.

After skidding, the logs are piled at the landing until they can be moved to the mill. If the landing lies near a road, trucks carry the logs to the mill. If it is on a railroad

line, flatcars transport the logs. Sometimes barges carry logs. Trucks transport the largest number of logs to sawmills.

From sawmill to lumberyard

The United States has about 5,700 sawmills that operate full-time and as many as 15,000 that operate part-time. Some 600 large sawmills account for about 95 percent of all softwood lumber and 25 percent of all hardwood lumber produced in the United States. Many mills produce less than 1 million board feet (2,400 cubic meters) of lumber a year. Some mills are so small that the *headrig,* or sawing machinery, can be loaded on a truck trailer and hauled into the woods.

Sawing logs. A moving conveyor chain carries the logs into the mill. In most mills, a *log debarker* removes the bark before the log reaches the first saw, called a *headsaw.* The bark must be removed because it is dirty and can dull saws. Bark also lowers the value of the pulp chips made from outer slabs of the log. One kind of debarker has metal bars or knives that rub off or chip off the bark. Another kind tears off the bark by the force of water shot onto the log under high pressure.

As a log enters the sawmill, it may be examined by an electronic scanner that measures its diameter and shape. Computers calculate how the log should be cut. Large logs are then moved onto a platform called a *carriage.* The carriage looks like a small railroad flatcar and is mounted on tracks. It carries the logs back and forth past the headsaw. Each time the carriage goes past the saw, the saw slices off a board until the log has become a pile of boards. Small logs are often cut into lumber in one pass through a group of saws that make many cuts at once. These groups of saws are called *gang saws.*

Moving belts then carry the newly made boards, called *green lumber,* to the *edger,* a set of smaller saws. These saws trim the rough edges from each board and make the sides straight and even. Next, the edged boards go to the *trimmer.* This set of saws makes the ends of the boards square, and cuts the boards to the exact lengths ordered by lumber dealers. The trimmer also cuts off weak or bad spots.

Grading lumber. The green boards, now called *rough lumber,* ride slowly on the *green chain,* a moving belt. Workers called *graders* walk along the green chain, examining the boards and sorting them according to size, quality, and kind of wood. Computerized grading systems that can automatically scan, grade, and mark lumber are being developed.

There are seven grades used by the National Hardwood Lumber Association to classify hardwood. They are, from highest to lowest: (1) *firsts and seconds* (FAS), (2) *selects,* (3) *No. 1 common,* (4) *No. 2 common,* (5) *sound wormy,* (6) *No. 3A common,* and (7) *No. 3B common.* The grades are based on the proportion of the wood that can be used to manufacture various products. If a large proportion can be used, the lumber receives a high grade. Hardwood finished market products, such as flooring and stair treads, are graded for their particular use. A high-grade piece of such lumber goes through little or no manufacturing.

Softwood-lumber associations use various grades for their lumber. Yard-lumber grades include *selects,* or *finish,* in grades A (highest quality) through D; *common boards,* numbered 1 through 5; and *common dimensions,* numbered 1 through 4. The lower numbers designate lumber of higher quality. Softwood factory lumber and shop lumber are graded for appearance. Softwood structural lumber is graded according to the load it can carry when used as beams, frames, joists, or planks.

Seasoning lumber means removing excess moisture from the wood. Over half the weight of green lumber may come from moisture. After seasoning, less than a tenth of the weight of the lumber may come from moisture. Mills also ship lumber without seasoning. But for most uses the moisture must be removed so the wood will not warp. In the process, the wood shrinks in size.

Mills sometimes season lumber by *air drying.* Workers stack the wood outdoors to let the sun and wind dry it. A quicker way of seasoning lumber is to put green lumber in *dry kilns,* or special heated buildings in which instruments control the temperature and moisture of the air. The instruments tell how much moisture remains in the wood. Some mills use both drying methods.

Planing. A small amount of rough lumber is used in construction. It is shipped to lumber dealers throughout the United States or in other countries. But the rest of the lumber must pass through a *planing mill* before it goes to market. In a planing mill, lumber passes through machines that have sharp knife blades or large *abrasive* (rough) sheets. The knives or sheets rotate against the rough boards, smoothing the surface. Lumber also receives further treatment to make it into dressed lumber or worked lumber.

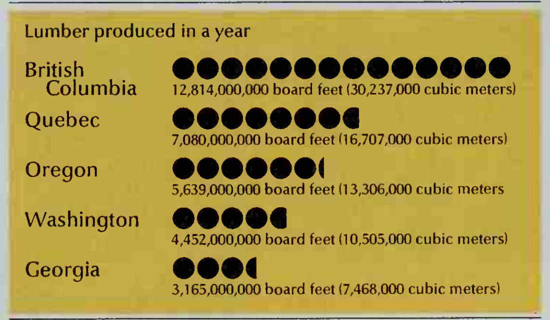
Leading lumber-producing countries

Lumber produced in a year

Country	Lumber produced
United States	46,733,000,000 board feet (110,276,000 cubic meters)
Canada	27,592,000,000 board feet (65,109,000 cubic meters)
China	11,429,000,000 board feet (26,969,000 cubic meters)
Brazil	8,090,000,000 board feet (19,091,000 cubic meters)
Russia	7,959,000,000 board feet (18,780,000 cubic meters)

Figures are for 1998.
Source: Food and Agriculture Organization of the United Nations.

Leading lumber-producing states and provinces



Figures are for 1998.
Source: U.S. Bureau of the Census; Canadian Forest Service.

How a sawmill saws large logs into lumber

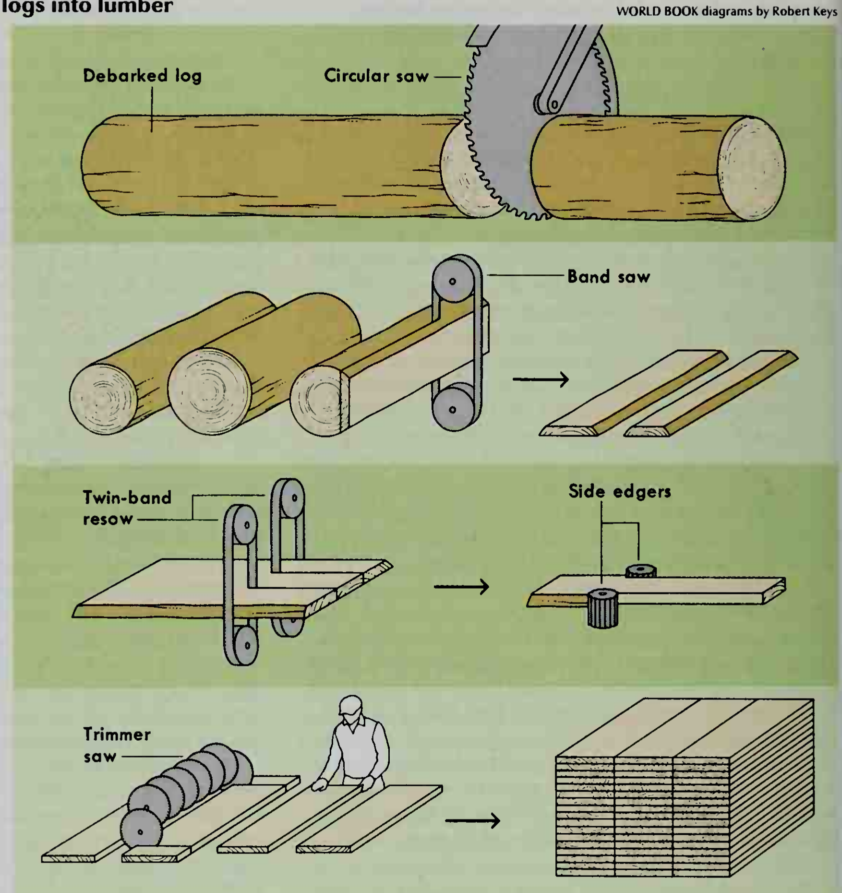
WORLD BOOK diagrams by Robert Keys

A circular saw cuts large logs into shorter lengths in a process called *bucking.* Before the logs reach the saw, a mechanical debarker strips them of their bark.

A headsaw slices each log into boards or other pieces of lumber. The headsaw shown in the diagram is a *band saw,* an endless steel belt that runs on two pulleys. The teeth of the saw are on an edge of the belt.

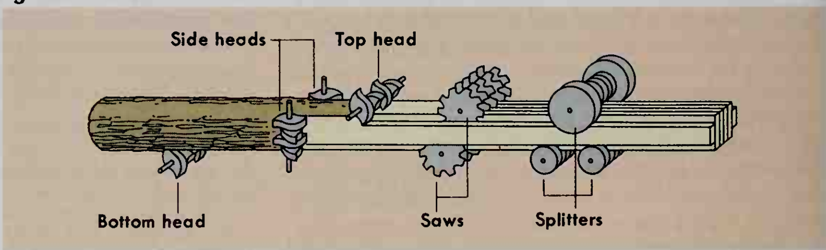
A resaw cuts lumber to its proper width and thickness. The lumber then goes through *side edgers.* These devices remove the rough edges and make the sides straight and even.

A trimmer saw cuts lumber to standard lengths and makes the ends square. Next, workers called *graders* sort the lumber according to size, quality, and kind of wood. The lumber is then stacked outdoors to dry.



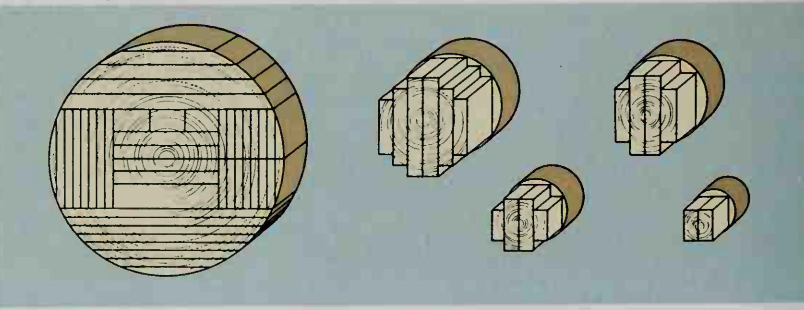
How a sawmill saws small logs into lumber

A chipper-canter, *right,* saws small logs. This machine has rotating *heads* (knives) that chip wood from the top, bottom, and sides of logs. A set of circular saws cuts each log into rectangular pieces called *cants.* Devices called *splitters* then separate the cants.



Patterns for sawing large and small logs

Log-sawing patterns vary, depending on the size of the log. Mills manufacture as much lumber as possible from each log. The diagram shows several patterns that may be used to saw large and small logs.



Shipping. Most mills ship lumber to wholesale dealers in the United States. The wholesalers sell to retail lumberyards, to factories that make wooden articles, and to construction companies. Most long-distance hauling of lumber is by rail. But ships bring large amounts of lumber from the West through the Panama Canal to markets on the East Coast. Trucks make most of the short lumber-carrying trips in all parts of the country.

Buying lumber

When selecting lumber, buyers should keep in mind the work they want it to do and the effect they wish to achieve. Lumber for decorative use should be chosen for its color, grain, knots, and texture. Construction applications require strong and durable lumber. Different kinds of wood are used for various types of construction. For example, Douglas-fir and southern yellow pine are used for structural timbers. Spruce, fir, and hemlock are used for framing lumber. Oak and maple are popular for flooring, and redwood and redcedar make fine siding.

In the United States, the width and thickness of lumber are expressed in inches, and the length in feet. For example, a 2 by 4 by 12 board is 2 inches thick, 4 inches wide, and 12 feet long. Lumber is measured before it is seasoned and planed, and so the finished pieces are actually smaller than the *nominal* (named) size. Lumber with a 4-inch nominal thickness is actually only 3½ inches thick.

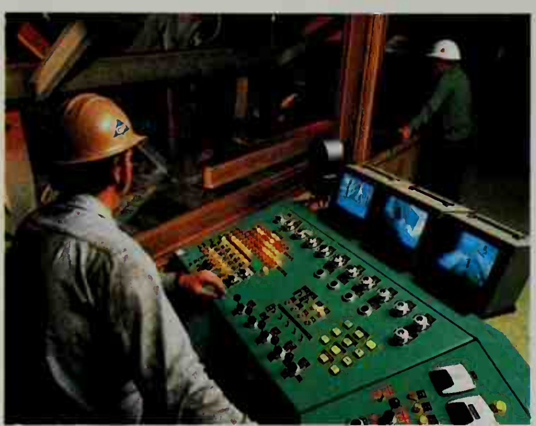
Standard nominal sizes of lumber vary depending on moisture content and on the type of wood or piece. Mills cut hardwood lumber into a variety of widths and into lengths that can be divided evenly into 1-foot sections. Softwood structural lumber is cut into lengths that can be divided evenly into 2-foot sections. Its nominal widths range from 2 to 16 inches. The nominal thickness of any lumber classifies it as a *board, dimension lumber,* or a *timber.* Boards have a nominal thickness of less than 2 inches; dimension lumber ranges from 2 inches to, but not including, 5 inches; and timbers measure 5 or more inches thick.

In Canada, the width and thickness of lumber are measured in millimeters, and length in meters. Lumber sizes are similar to those used in the United States, but lengths can be divided into 0.3-meter sections. Nominal sizes are not used in Canada. Instead, Canadians sell lumber according to the actual dry size for thickness and width. Canadian standard terms for lumber sizes round off the thickness and width to the nearest millimeter.

United States lumber prices generally refer to 1,000 board feet (2.4 cubic meters). Lumber priced at $400 for 1,000 board feet would sell at 40 cents per board foot. Canadian lumber prices usually refer to 1,000 cubic meters.

History

For thousands of years, forests have contributed to human progress. Primitive people built homes out of branches or logs. They used wood as handles for their tools and weapons. Planks cut from logs were joined by crosspieces and rounded to make wheels for early carts. Logs fastened together formed rafts. Wood used as fuel provided warmth and a means of cooking.



© John Blaustein, Woodfin Camp, Inc.

A laser scanner at a sawmill gives the exact dimensions of a log. The dimensions are then entered into a computer to determine the most efficient cutting to yield the most planks.

The pioneers of North America began to clear vast forests. Lumbering was one of the first industries in the colonies. The colonists traded with Europe, sending white pine logs, hoops, clapboards, wainscoting, and naval stores.

Plenty of raw material was available in those days. Heavy, dark forests covered the eastern half of what is now the United States, and most of Canada. Trees had to be cut down to make way for roads and farms.

The first boards manufactured in the colonies were sawed over pits. One person stood beneath and another above a log, at the ends of a two-person saw. Sawmills probably first appeared in the United States in Virginia and Maine between 1608 and 1623. The earliest sawmills were crude, water-powered mills. Steam power replaced water power in the mills about 1830.

In the 1860's, the lumber industry centered in Pennsylvania. As settlers cut down forests and cleared land, the industry moved toward the West and South. By 1870, it had moved into Michigan. By 1909, the South led in lumber production. The center of the lumber industry was



Manitowoc Engineering Company

Removing the bark prepares a log to be sawed into lumber. A safety guard has been removed from the machine shown above so that the debarking process can be seen in this photograph.

Sizes of softwood boards and dimension lumber in the United States and Canada

In the United States, the thickness and width of lumber are expressed in inches. The actual size of the lumber is smaller than the *nominal* (named) size because the lumber is measured before being planed. For example, a 1 × 2 board—called a *1 by 2*—actually measures $\frac{3}{4}$ inch thick and $1\frac{1}{2}$ inches wide. In Canada, the thickness and width are expressed in millimeters. Canadian standard sizes round off the actual size to the nearest millimeter.

Boards

Nominal size (U.S.)	Actual size of dry lumber in inches (U.S.)	Standard size (Can.)	Actual size of dry lumber in millimeters (Can.)
1 × 2	$\frac{3}{4} \times 1\frac{1}{2}$	19 × 38	19.05 × 38.10
1 × 4	$\frac{3}{4} \times 3\frac{1}{2}$	19 × 89	19.05 × 88.90
1 × 6	$\frac{3}{4} \times 5\frac{1}{2}$	19 × 140	19.05 × 139.70
1 × 8	$\frac{3}{4} \times 7\frac{1}{4}$	19 × 184	19.05 × 184.15
1 × 10	$\frac{3}{4} \times 9\frac{1}{4}$	19 × 235	19.05 × 234.95
1 × 12	$\frac{3}{4} \times 11\frac{1}{4}$	19 × 286	19.05 × 285.75

Dimension lumber

Nominal size (U.S.)	Actual size of dry lumber in inches (U.S.)	Standard size (Can.)	Actual size of dry lumber in millimeters (Can.)
2 × 2	$1\frac{1}{2} \times 1\frac{1}{2}$	38 × 38	38.10 × 38.10
2 × 4	$1\frac{1}{2} \times 3\frac{1}{2}$	38 × 89	38.10 × 88.90
2 × 6	$1\frac{1}{2} \times 5\frac{1}{2}$	38 × 140	38.10 × 139.70
2 × 8	$1\frac{1}{2} \times 7\frac{1}{4}$	38 × 184	38.10 × 184.15
2 × 10	$1\frac{1}{2} \times 9\frac{1}{4}$	38 × 235	38.10 × 234.95
2 × 12	$1\frac{1}{2} \times 11\frac{1}{4}$	38 × 286	38.10 × 285.75
4 × 4	$3\frac{1}{2} \times 3\frac{1}{2}$	89 × 89	88.90 × 88.90
4 × 6	$3\frac{1}{2} \times 5\frac{1}{2}$	89 × 140	88.90 × 139.70
4 × 8	$3\frac{1}{2} \times 7\frac{1}{4}$	89 × 184	88.90 × 184.15
4 × 10	$3\frac{1}{2} \times 9\frac{1}{4}$	89 × 235	88.90 × 234.95
4 × 12	$3\frac{1}{2} \times 11\frac{1}{4}$	89 × 286	88.90 × 285.75

in the Pacific Northwest from about 1920 to the mid-1970's. It then returned to the South.

The lumber industry in Canada became important during the 1800's. Canada exported timber to Great Britain, and to the United States after the mid-1800's. Most of the lumber in the early 1800's came from eastern Canada. By 1900, British Columbia had become an important source. It is now Canada's chief source of lumber.

Jim L. Bowyer

Related articles in *World Book* include:

Carpentry
Colonial life in America (Lumbering and shipbuilding)
Forest products
House
Plywood
Rot
Tree
Weyerhaeuser, Frederick
Wood
Woodworking

Outline

I. Kinds of lumber
A. Softwood lumber
B. Hardwood lumber
C. Composite lumber

II. From forest to sawmill
A. The life of a logger
B. Cutting down trees
C. Transporting logs

III. From sawmill to lumberyard
A. Sawing logs
B. Grading lumber
C. Seasoning lumber
D. Planing
E. Shipping

IV. Buying lumber

V. History

Questions

What is the most important use of lumber?
How do fallers aim a tree?
What is high-lead logging?
What part does a forester play in lumber production?
Why is bark removed from logs before they are sawed?
How may lumber be seasoned?
How was lumber sawed in colonial times?
What is a *board foot*?
How does softwood lumber differ from hardwood lumber?
What kinds of wood are most important in homebuilding?

Lumen. See **Candela; Light** (Measuring light).

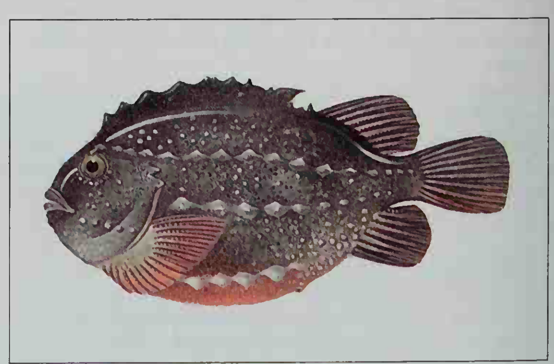
Lumière brothers, *loo MYAIR,* were two French brothers who became noted scientists. Auguste (1862-1954) and Louis Jean (1864-1948) became known for their work in photochemistry. In 1895, they invented the *Cinematographe,* a combination motion-picture camera, printer, and projector. Some of the first motion pictures were produced and shown to audiences with this apparatus. In 1904, the Lumière brothers patented the *autochrome plate,* the first popular direct-color photographic process. The Lumière brothers were born in Besançon, France. Richard Rudisill

Luminescence, *loo muh NEHS uhns,* is the giving off of light by means other than heat. The emission of light by means of heat is known as *incandescence.* Luminescence usually involves visible light. But luminescence can also refer to infrared and other forms of light the eye cannot see.

For a substance to become luminescent, the electrons in its atoms must absorb energy. The electrons get rid of this excess energy by giving off light. The energy to produce luminescence can come from various sources, including electric current, X rays, ultraviolet rays, and certain chemical reactions.

Light given off by fireflies and other living things is called *bioluminescence.* Luminescence that stops as soon as the energy source is removed is called *fluorescence.* Luminescence that lasts for seconds or even days after the energy source is removed is called *phosphorescence.* See **Bioluminescence; Fluorescence; Phosphorescence.** David M. Roessler

Lumpfish is a fish that lives near the shore in the cold ocean waters of northern regions. Its body and head are thick and short. The lumpfish has wartlike *tubercles* (lumps) instead of scales. Fins on the underside of the body are joined to form a sucking disk that enables the



WORLD BOOK illustration by Colin Newman, Linden Artists Ltd.

A male lumpfish has a reddish underside.

fish to cling to rocks. The underside of a male lumpfish is reddish in color. People eat the eggs of lumpfish as caviar. William J. Richards

Scientific classification. The lumpfish belongs to the family Cyclopteridae. Its scientific name is *Cyclopterus lumpus.*

Lumpy jaw. See Actinomycosis.

Lumumba, Patrice. See Congo (Kinshasa) [History].

Luna, *LOO nuh,* was the goddess of the moon in Roman mythology. The word *luna* is the Latin word for *moon.* Luna protected crops and controlled the menstrual cycle of women. She drove across the sky at night in a chariot. To explain moonless nights, the Romans claimed that Luna had fallen in love with a mortal shepherd named Endymion and had left the sky to visit him.

Elaine Fantham

See also Endymion; Monday; Selene.

Lunar eclipse. See Eclipse (with picture); Moon (Eclipses).

Lunar month. See Calendar.

Lunda, *LOON duh* or *LOON dah,* are a people who live in Congo (Kinshasa), Angola, and Zambia. They ruled several central African kingdoms from the 1600's to the 1800's.

Most Lunda live in small rural villages and farm the land for a living. They grow a root crop called cassava and several grains, including corn, millet, and sorghum. They also fish and sell their catch to towns in the rich copper-mining areas of Congo (Kinshasa) and Zambia. Since about 1960, large numbers of Lunda have moved from rural areas to towns and cities. The people speak a language that belongs to the Bantu group of African languages (see Bantu). Many Lunda are Christians.

During the early 1600's, the Lunda formed a powerful kingdom under a series of rulers called the *mwaant yaar* (king). The Lunda kingdom became one of central Africa's largest empires. It covered large parts of what are now Congo (Kinshasa), Angola, and Zambia.

During the 1700's, several groups broke away from the Lunda empire and established their own kingdoms. One of these kingdoms—Kazembe in northeastern Zambia—became a major center of commerce in the 1800's. Kazembe carried on long-distance trade with people on the east and west coasts of Africa.

In the 1900's, the Lunda played a major role in African political developments. The Lunda in Zambia helped drive out the British colonial rulers in 1964. The Lunda in Congo's Katanga Province (now the Shaba Region) participated in a movement to make the province independent. This struggle resulted in a series of armed revolts during the 1960's and 1970's. Also in the 1970's, the Lunda took part in a civil war in Angola between rival groups that wanted to rule the country.

Robert H. Bates

Lundy, Benjamin (1789-1839), was an American editor and a pioneer of the antislavery movement in the United States.

In 1815, Lundy organized the Abolitionist Union Humane Society in St. Clairsville, Ohio. He organized other antislavery groups and published *The Genius of Universal Emancipation,* the *National Enquirer,* and other periodicals. Lundy lectured and traveled widely, seeking places for free blacks. He influenced John Quincy Adams's efforts to prevent the expansion of slavery, when Adams was a congressman. Lundy was born on Jan. 4, 1789, in Sussex County, New Jersey. He died on Aug. 22, 1839. James C. Curtis

See also Garrison, William Lloyd.

Lundy's Lane, Battle of. See War of 1812 (Lundy's Lane; map).

Lung is the breathing organ of mammals, birds, and reptiles. Most adult amphibians also have lungs. The main job of the lungs is to exchange gases. As blood flows through the lungs, it picks up oxygen from the air and releases carbon dioxide. The body needs oxygen to obtain energy from food, and it produces carbon dioxide as a waste product. This article discusses the human lungs, but the lungs of other animals function in a similar way.

Parts of the lungs. Human beings have two lungs—a left lung and a right lung—which fill up most of the chest cavity. A lung has a spongy texture and may be thought of as an elastic bag filled with millions of tiny air chambers called *alveoli.* If the walls of the alveoli could be spread out flat, they would cover about half a tennis court. The somewhat bullet-shaped lungs are suspended within the ribcage. They extend from just above the first rib down to the *diaphragm,* a muscular sheet that separates the chest cavity from the abdomen. A thin, tough membrane called the *visceral pleura* covers the outer surface of the lungs. The heart, large blood vessels, and *esophagus* (tube connecting the mouth and stomach) lie between the two lungs.

The lungs are designed to receive air, which enters the body through the mouth or nose. The air passes through the *pharynx* (back of the nose and mouth) and the *larynx* (voice box) and enters the *bronchial tree*—a system of tubes that leads to the alveoli. The largest of these tubes is the *trachea* (windpipe), which divides into two smaller tubes called *bronchi.* Each bronchus leads to one lung. Within the lung, the bronchus divides further into smaller and smaller tubes, much as a tree limb divides into branches and twigs. The final "twigs" are tiny tubes called *bronchioles.* The smallest bronchioles, called *terminal bronchioles,* lead to the *respiratory units* of the lung. The respiratory units are made up of many *alveolar ducts.* Each duct supplies about 20 alveoli. The thin walls of each alveolus contain networks of extremely small blood vessels called *pulmonary capillaries.* Gas is exchanged between the blood in these capillaries and the gas in the alveoli.

Three to five terminal bronchioles and the alveoli that they supply with air form a *lobule.* Many lobules unite to form the major subdivisions of the lung, called *lobes.* The left lung has two lobes, and the right lung has three. Each lobe has its own branches of bronchi and blood vessels, so a diseased lobe may be removed without sacrificing the usefulness of the other lobes.

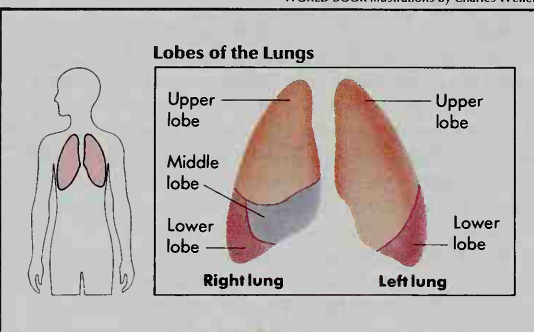
Blood reaches the lung through two routes. Almost all of the blood comes through the *pulmonary circulation.* This blood has already circulated through the body tissues, where it has given up oxygen and picked up carbon dioxide. A small amount of blood reaches the lungs through the *bronchial circulation.* This blood is rich in the oxygen and nutrients that the airway tissues—like all other body tissues—need.

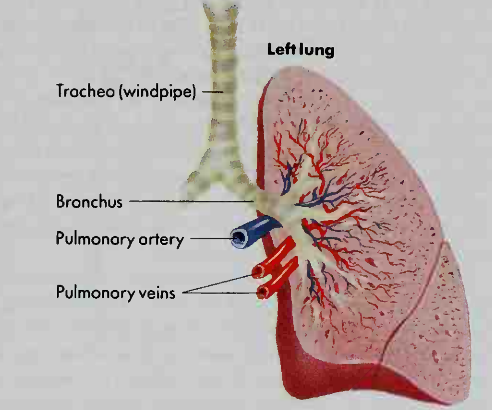
Gas exchange in the lungs. To supply oxygen to the blood and remove carbon dioxide from it, the lungs need to draw in fresh gas and expel stale gas. Fresh

Parts of a human lung

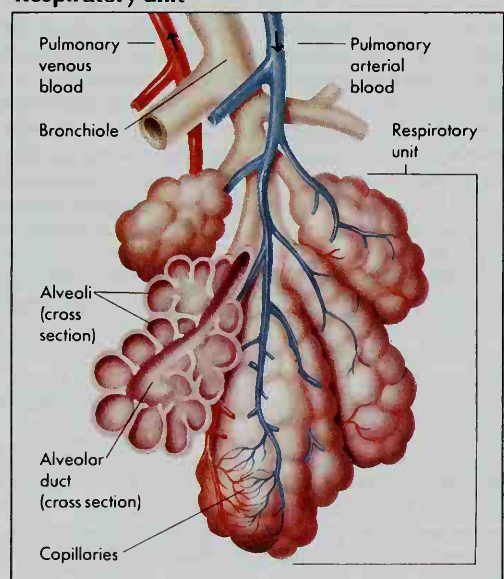
The right lung consists of three lobes, and the left lung, two. Air enters a lung through a *bronchus*, which splits into *bronchioles*. Each bronchiole leads to a *respiratory unit* with *alveoli*.

WORLD BOOK illustrations by Charles Wellek





Respiratory unit



Gas exchange takes place within respiratory units. Gas moves in and out of alveoli via the bronchial tree. As blood moves through the capillaries in the alveoli walls, the blood picks up oxygen and releases carbon dioxide.

gas is drawn in when the diaphragm and other muscles in the chest wall contract. This action—called *inspiration* or *inhalation*—makes the chest volume larger and causes the lungs to expand. The expansion lowers the pressure in the lungs, and air from the atmosphere flows in. When the muscles relax, the lungs return to a smaller volume, and gas flows out into the atmosphere. This action is called *expiration* or *exhalation*.

Blood entering the lungs through the pulmonary circulation is dark-colored, low in oxygen, and high in carbon dioxide. It is pumped by the right side of the heart into the *pulmonary arteries*, which lead to the lungs. The pulmonary arteries divide into smaller and smaller blood vessels, ending with pulmonary capillaries in the walls of the alveoli. The alveolar walls are so thin that oxygen and carbon dioxide move through them easily. Oxygen passes from the alveoli to the blood in the capillaries. At the same time, carbon dioxide leaves the blood and enters the alveoli. As this exchange takes place, the blood becomes bright red. It then enters the *pulmonary venous system*. In this system, small vessels join to form larger vessels. The largest vessels, the *pulmonary veins*, carry blood to the left side of the heart. The oxygen-rich blood is then pumped by the left side of the heart back to the body tissues.

Other jobs of the lungs. Because the lungs must inhale the air from the environment, they are exposed to bacteria, viruses, dust, and pollutants that are mixed with the air. A sticky fluid called *mucus* lines the airways and traps most of these foreign substances. Tiny, hairlike structures called *cilia* move together in a wavelike manner that pushes the mucus upward into the throat. There, the mucus and its trapped "invaders" are coughed up or harmlessly swallowed. Some substances do not get caught in the mucus and thus enter the alveoli. There, special cells called *alveolar macrophages* engulf the particles and, in most cases, destroy them.

The lungs also help clean the blood of certain harmful substances. Blood flowing through the capillaries of the lung is filtered so that particles such as blood clots and fat globules are removed. Special cells and enzymes then break up and remove the trapped material.

Another function of the lungs can be compared to the operations of a chemical processing plant. Some cells make a fatty substance called *surfactant*, which coats the alveoli and allows them to expand easily. Other cells add, remove, or change chemical substances in the blood that affect the function of the lungs or other organs. Finally, the gas exhaled by the lungs is used to make the vocal cords in the larynx vibrate. This action creates the sound necessary for speech.

Diseases of the lungs occur despite the defenses provided by the mucus and macrophages. Sometimes, the number of harmful particles reaching the alveoli is so great that the macrophages cannot remove them all. In other cases, the particles can resist or destroy the macrophages and remain in the lung tissue.

Because lung diseases can result from many different causes, they are usually grouped by how they affect lung functions. *Obstructive lung diseases*, such as emphysema, asthma, and chronic bronchitis, cause the airways to become partly blocked or narrower, making it more difficult for air to move through them. Cigarette smoking and air pollution are major causes of these dis-

eases. *Restrictive lung diseases* make it harder for the respiratory system to expand. They can cause a stiffening of the lung or chest wall or make the respiratory muscles unable to respond to nerve signals from the brain. Breathing substances such as asbestos, silica, and coal dust can cause some restrictive diseases. *Pulmonary vascular diseases* affect the circulation of blood in the lungs. For example, in pulmonary hypertension, the lung's small blood vessels become narrower, making it difficult for the right side of the heart to pump blood.

Some diseases are difficult to categorize because they can harm the lungs in a number of ways. Some pollutants—particularly cigarette smoke—affect the cilia, causing the upward movement of mucus to slow or stop. Smoking cigarettes is also a major cause of lung cancer. Infectious lung diseases, such as tuberculosis and pneumonia, are caused by bacteria, viruses, or other organisms. These diseases are serious health concerns in all parts of the world. Harold I. Modell and Jack Hildebrandt

Related articles. See the Trans-Vision three-dimensional picture with **Human body**. See also:

Asthma
Black lung
Bronchitis
Bronchodilator
Brown lung
Cancer (diagram: How lung cancer develops)
Circulatory system
Diaphragm
Drowning
Emphysema
Heart
Histoplasmosis
Human body (picture: Carbon dioxide)
Hyaline membrane disease
Iron lung
Larynx
Legionnaires' disease
Lung cancer
Nose
Pharynx
Pleura
Pleurisy
Pneumonia
Pneumothorax
Respiration
Sarcoidosis
Trachea
Tuberculosis

Lung cancer is an uncontrolled, extremely deadly division of cells in the lung. In most developed countries, it kills more men and women than any other form of cancer. The death rate is high because many lung cancers have spread through the body by the time symptoms appear. Once lung cancer has spread, it is extremely difficult to cure.

Smoking causes most cases of lung cancer. The risk of developing lung cancer increases according to the length of time and the amount a person smokes. Exposure to secondhand smoke also increases risk. Other causes include long-term exposure to a radioactive gas called *radon* or to airborne asbestos fibers.

Symptoms of lung cancer include persistent cough, weight loss, shortness of breath, coughing up blood, chest pain, or a hoarse voice. If lung cancer is suspected, doctors may begin their examination by examining a patient's *sputum* (coughed-up material) for cancer cells. Patients may also have a chest X ray to reveal suspicious masses or other signs of lung disease.

Doctors further investigate abnormal lung areas by obtaining a *biopsy* (sample of tissue) and examining it under a microscope. In one biopsy procedure, doctors pass a thin, lighted tube called a *bronchoscope (BRAHNG kuh skohp)* into the *bronchi (BRAHNG ky)*. The bronchi are the lung's breathing tubes, where most cancers form. Doctors can test other lung parts with a technique called *video thoracoscopy (THAWR uh KAHS kuh pee)*. In this technique, tiny cameras inserted into the chest send detailed pictures to a big screen, enabling doctors to find and sample abnormalities.

If diagnostic tests show cancer, doctors identify the type of lung cell from which the cancer developed. The various types of cells respond differently to treatments. Treatment also depends on whether the cancer has spread beyond the lung. Many lung cancers spread first to *lymph nodes* in the chest. These nodes are small masses of tissue that help fight disease by filtering out bacteria and other harmful particles. Other sites invaded by lung cancer include bones, the brain, and the liver.

Doctors can sometimes cure patients whose cancer has not spread. If cancer appears confined to the lung and the patient is otherwise healthy, surgeons usually remove all or part of the lung. During surgery, doctors also remove lymph nodes and test them for cancer cells.

Few patients whose cancer has spread can be cured. Treatment of these patients aims at extending life and reducing pain. Doctors may prescribe drug treatments—called *chemotherapy*—or radiation therapy to try to shrink tumors and relieve symptoms. Marc B. Garnick

See also **Bronchoscope; Cancer; Lung.**

Lungfish is a type of fish that can breathe out of water. It breathes air by means of a lunglike organ called a *swim bladder* or *gas bladder*. The lungfish is one of the oldest known kinds of fish. Scientists have found fossils of lungfish that date from about 400 million years ago. Many scientists believe that land-dwelling *vertebrates* (animals with a backbone) developed from the lungfish.

There are six species of lungfish. They live in freshwater marshes, swamps, and rivers. Four species are found in Africa, one in Australia, and one in South America. African lungfish are the largest kind. Some grow up to 7 feet (2 meters) long.

The Australian lungfish is the most primitive of the six species. It breathes chiefly with its gills. The Australian lungfish gulps air at the water's surface only when the water contains little oxygen. This lungfish has a long, broad body and two pairs of flipperlike fins.

African and South American lungfish are eel-shaped with two pairs of long, threadlike fins. These lungfish have poorly developed gills and breathe almost entirely with their "lung." If held underwater, they will drown. African and South American lungfish can survive hot, dry periods when the water in which they live dries up. At such times, they tunnel into the mud and remain there inactive until the rains return. This behavior is called *estivation*. During estivation, lungfish live off protein stored in their muscle tissues. African lungfish estivate inside a cocoon made of mud and a slimy substance given off by their bodies. This cocoon can be easily dug from the ground and the fish removed for food.

Lungfish eat mainly small fish and other water animals, such as frogs and snails. Female lungfish lay eggs. Among African and South American lungfish, the males fiercely protect the eggs and young. John E. McCosker

Scientific classification. Lungfish make up the order Dipteriformes in the class of bony fish, Osteichthyes. African lungfish are in the family Protopteridae. South American lungfish make up the family Lepidosirenidae. Australian lungfish make up the family Ceratodontidae.

See also **Fish** (Fleshy-finned fish).

Lungwort is a name given to several different plants. The most common of these plants is an herb known as the *Virginia bluebell*. It grows from southern Canada to South Carolina, and west to Kansas. A similar plant, called *lanceleaf lungwort*, grows from Saskatchewan to New Mexico. Both plants have smooth stems, large leaves, and bell-shaped flowers. The flowers appear

pink at first but turn blue. See **Bluebell.**

An herb called the *blue lungwort* grows in Europe. It has small blue flowers and white-spotted leaves. It was once a popular remedy for lung diseases.

An olive-green lichen of North America and Europe is also sometimes called lungwort. It is found on tree trunks in mountainous regions. J. Massey

Scientific classification. Most lungworts are in the borage family, Boraginaceae. The scientific name for the Virginia bluebell is *Mertensia virginica.* The lanceleaf is *M. lanceolata.* The blue lungwort is *Pulmonaria officinalis.*

Lunt, Alfred (1892-1977), was one of the outstanding American actors of his generation. He was noted for his distinguished voice and expressive eyes and manner.

In 1922, Lunt married the British-born actress Lynn Fontanne and thereafter rarely performed without her. Lunt and Fontanne became the most famous acting team in the American theater. They co-starred in 27 productions, including *The Guardsman* (1924), *The Doctor's Dilemma* (1927), *Design for Living* (1933), *The Taming of the Shrew* (1935), *Idiot's Delight* (1936), *The Seagull* (1938), and *The Visit* (1958).

Lunt was born in Milwaukee. He made his professional debut in 1912 and later toured with the actresses Lillie Langtry and Margaret Anglin. He achieved his first significant success in the title role in *Clarence* (1919).

Daniel J. Watermeier

See also **Fontanne, Lynn.**

Lupine, *LOO puhn,* is the name of a group of plants in the pea family. Lupines have wandlike clusters of showy blue, yellow, white, or red flowers that resemble sweet peas. The leaves have several narrow leaflets, all attached at the same point. About a hundred kinds of lupines grow in North America. Some kinds contain poisonous alkaloids, but the seeds of others can be eaten after they have been properly prepared and cooked.

Daniel F. Austin

See also **Bluebonnet; Flower** (pictures: Garden perennials; Flowers of the Arctic tundra).

Scientific classification. The lupines are classified as members of the pea family, Fabaceae or Leguminosae. They make up the genus *Lupinus.*

Lupus, *LOO puhs,* is the name of any of a group of diseases that affect the skin. The word generally refers to the disease *lupus erythematosus.* But it may also refer to *lupus vulgaris,* which is a tuberculosis of the skin of the face. This article discusses lupus erythematosus.

The most serious form of lupus erythematosus is *systemic lupus erythematosus* (SLE), which attacks many internal organs as well as the skin. People with SLE have such symptoms as fever, painful and swollen joints, and a butterfly-shaped rash across the nose and cheekbones. They also may suffer sores in the mouth and nose, lose their hair, and be sensitive to sunlight. Most victims are women from 15 to 35 years old. SLE occurs about four times as frequently in blacks as in whites.

SLE's basic cause is unknown, but researchers believe it involves a breakdown of the body's *immune system.* Usually, this system protects the body from infection by making *antibodies* (substances that attack harmful bacteria and viruses). In SLE, the immune system apparently produces antibodies that attack healthy tissue instead.

Mild cases of SLE require no treatment. Physicians treat more severe cases with such drugs as aspirin and cortisone, which reduce inflammation in internal organs. Severe cases of SLE can be fatal, especially if the kidneys are damaged. SLE cannot be cured completely, but most patients under treatment for the disease have no symptoms for long periods.

Another form of lupus, *discoid lupus erythematosus* (DLE), affects only the skin. In rare cases, DLE may leave scars or develop into SLE. Michael D. Lockshin

Luray Caverns, *LOO ray* or *lu RAY,* are a group of caves near Luray, Virginia. The caverns lie in a limestone belt of the Shenandoah Valley on the west side of the Blue Ridge Mountains. The caves were formed as underground water slowly dissolved the limestone. The caves have many large rooms. Some are more than 140 feet (43 meters) high. Some of the colorful hanging rocks, called *stalactites,* are over 50 feet (15 meters) long. The caverns were discovered by Andrew J. Campbell and his companions in August 1878. See also **Stalactite** (picture). Michael P. O'Neill

Lusaka, *loo SAH kuh* (pop. 818,994), is the capital and largest city of Zambia. The city lies on a high plateau in south-central Zambia. It is near the midpoint of a railroad and at the junction of two main roads. For location, see **Zambia** (map).

Lusaka has many large buildings, including the parliament buildings and the University of Zambia. Most of the city's commercial and government buildings stand along wide, shaded streets. Lusaka is a city of contrasts, with upper-class areas and slums. The city has several scenic parks. The main shopping district is famous for open-air bazaars that sell handmade items.

Lusaka is a trade center and a major market for farm products raised in rural areas of Zambia. Its main industries make cement, furniture, shoes, and textiles and process beverages, food, and tobacco. Zambia's government employs many of the city's people.

European settlers established Lusaka about 1905 as a small trading post. It was originally called *Lusaakas.* The city came under British rule in the early 1900's. In 1935, Britain made Lusaka the capital of its colony of Northern Rhodesia. The colony became the independent nation of Zambia in 1964. James Pletcher

See also **Zambia** (picture).

Lüshun, *lyoo shun,* lies near the tip of the Liaodong Peninsula in northern China (see **China** [political map]). Lüshun is a district in the Dalian municipality. Lüshun was formerly called *Port Arthur.* There are two sections in Lüshun, the old Chinese city and the new town built by the Russians when they took Lüshun in 1898.

The British named the city Port Arthur when they used it as a base to fight China in 1857. Later, it became a Chinese naval base. Japan took Lüshun from Russia in 1905, after winning the Russo-Japanese War. After World War II ended in 1945, China and the Soviet Union agreed to share the port as a naval base. At that time, Lüshun was combined with the city of Dalian, and, together, they were called Lüda. In 1955, the Soviet Union returned Lüshun to full Chinese control. Frederic Wakeman, Jr.

Lusitania, *LOO sih TAY nee uh,* was a British passenger ship that sank near Ireland after the German submarine *U-20* torpedoed it on May 7, 1915, during World War I. A total of 1,198 people died, including 128 Americans. Many people considered the sinking an act of barbarism. Afterward, Germany stopped attacking neutral

and passenger ships around Britain for nearly two years.

The German government had claimed the *Lusitania* was a legal target because it was armed and carried war materials. An official British inquiry denied that the ship was armed but confirmed that it had a supply of ammunition. As a result of the sinking, support for Britain increased in the United States. The United States entered the war in 1917, and "Remember the *Lusitania*!" became a common slogan. James L. Stokesbury

Lute is an ancient stringed musical instrument. It has a pear-shaped body, a neck with a *fretted* (ridged) finger board, and a *pegbox* attached to the neck at a sharp angle. The pegs are turned to tune the 11 strings, which run along the neck to a low *bridge* near the bottom of the body. The player plucks the strings with the thumb and fingers of the right hand. The fingers of the left hand press down on the strings along the neck to set the pitch. Abram Loft



Claire Rydell

The lute is an ancient stringed instrument. The body and neck resemble those of a large mandolin, but the angle at which the head is set into the neck gives it a distinctive appearance.

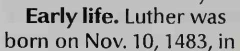
Lutetium, *loo TEE shee uhm* (chemical symbol, Lu), is one of the rare-earth metals. It has an atomic number of 71 and an atomic weight of 174.967. The name comes from *Lutetia,* the ancient name for Paris. The French scientist Georges Urbain discovered lutetium in 1907. He developed a process for separating the original element ytterbium into two elements, lutetium and ytterbium, or neoytterbium. Lutetium is found with ytterbium in the minerals gadolinite, xenotime, and other minerals that bear rare earths. It is best separated from the other rare earths by ion-exchange or solvent-extraction processes. The metal has a silver color. It has a melting point of 1663 °C and a boiling point of 3402 °C. It has a density of 9.84 grams per cubic centimeter at 25 °C (see **Density**). It is the heaviest rare-earth element. See also **Element, Chemical; Rare earth; Ytterbium.** Larry C. Thompson

Luther, Martin (1483-1546), was the leader of the Reformation, a religious movement that led to the birth of Protestantism. Luther, a German theologian, taught that the Bible should be the sole authority in the church. He also taught that people are *justified* (made righteous in the eyes of God) solely through faith in Christ, apart from any works of their own. He did not intend to establish a new church, but Luther's theology led to beliefs and practices quite different from those of the Roman Catholicism of his day.



Detail of an oil portrait on wood (1526) by Lucas Cranach; Nationalmuseum, Stockholm

Martin Luther



Early life. Luther was born on Nov. 10, 1483, in Eisleben, Saxony. His father intended him to have a career in the law. Luther enrolled at the University of Erfurt in 1501, but in 1505 he abandoned his legal studies and entered a monastery. Luther was ordained a priest in 1507, and by 1512 he was a professor of Biblical theology at Wittenberg University. He held that position for the rest of his life.

The Ninety-Five Theses. The first controversy in which Luther became involved concerned *indulgences.* The church had created indulgences as a means of releasing sinners from part of the penalty for their sins. For example, individuals could be ordered to go on a pilgrimage in penalty. An indulgence permitted them to contribute a certain amount of money to a worthy cause instead. But the practice of selling indulgences was sometimes abused as a means of raising money.

In 1515, Pope Leo X authorized Archbishop Albrecht of Mainz to sell indulgences, in part to raise money for the building of St. Peter's Basilica in Rome. Albrecht's indulgence seller, Johann Tetzel, told potential buyers that an indulgence freed them from punishment for their sins and could even release souls from purgatory. In October 1517, Luther sent a letter to Albrecht denouncing Tetzel's tactics. He enclosed with the letter a list, known as the Ninety-Five *Theses* (articles for academic debate), that criticized indulgences. According to tradition, Luther also posted the Ninety-Five Theses on the door of the Wittenberg Castle Church, which acted as the university's bulletin board.

In writing the theses, Luther had no intention of breaking with the church or of attacking the legitimate authority of the papacy. Luther's concerns involved theology and the duties of a priest. He feared that urging people to seek escape from divine punishment through indulgences would lead them away from true sorrow for their sins and into a dangerous sense of false security. But by early 1518, the Ninety-Five Theses were circulating throughout the Holy Roman Empire—a German-based empire in western and central Europe—and prompting widespread debate. Against Luther's wishes, the controversy over the sale of indulgences was gradually transformed by his critics into a debate over the authority of the pope.

Justification by faith. It was probably about the time of the indulgence controversy that Luther came to his new understanding of justification by faith. This understanding involved a response to the question: How do people find favor with God? According to Roman

Catholic doctrine, people were justified partly through *works* done in a state of grace—that is, their divinely assisted moral goodness and faithfulness to duty.

Based on his reading of the Gospels and the Letters of Saint Paul, Luther came to believe that people are justified solely through faith in God's promise that Christ died for their salvation. In this view, when sinful people trust the Scriptural message that Christ died for their sins, Christ takes their place before God's judgment seat and God finds them "not guilty" for Christ's sake. People cannot earn faith, however. God gives faith as a gift. Once justified by faith, believers are led by the Holy Spirit to be more loving toward God and their neighbor and to do good works. But these works are the result of justification, rather than the means by which people are justified.

The break with the Roman Catholic Church. By the summer of 1519, Luther had publicly criticized papal claims to authority. In a debate with Catholic professor and theologian Johann Eck in Leipzig in July 1519, Luther went one step further. He asserted that not only could popes be in error, but so could *ecclesiastical councils*—meetings of church authorities for the purpose of determining doctrine. Scripture had become, for Luther, the sole authority for religious truth.

The final break between Luther and the church came in 1520. In that year, Luther published three highly influential works—*To the Christian Nobility of the German Nation, The Babylonian Captivity of the Church,* and *The Freedom of a Christian.* These works spelled out Luther's understanding of Christianity and attacked the papacy and many traditional practices. Luther claimed that all baptized believers are spiritually equal in God's eyes because all must depend on faith in Christ. As a result, he argued that monks and nuns were not special and that clergy should be subject to the same laws and taxes as other people. Luther also criticized pilgrimages, devotion to saints, and other practices that he claimed emphasized works rather than faith. In addition, he reduced the number of sacraments from seven eventually to two, baptism and the Lord's Supper (see Sacrament). These new views were too radical for the papacy, and in January 1521, Luther was formally *excommunicated* (expelled from the church).

The Diet of Worms. In April 1521, Luther was given a hearing before Holy Roman Emperor Charles V at a *diet* (meeting) at Worms, Germany. Luther was urged to retract his teachings, but he refused. He made his famous statement: "Unless I am convinced by the testimony of the Scriptures or by clear reason (for I do not trust either in the pope or in councils alone, since it is well known that they have often erred and contradicted themselves), I am bound by the Scriptures I have quoted and my conscience is captive to the word of God. I cannot and I will not retract anything, since it is neither safe nor right to go against conscience."

The emperor declared Luther an outlaw. On his journey home from Worms, Luther was taken by supporters and hidden at Wartburg Castle. There, he translated the New Testament into German.

Reformation leader. In the spring of 1522, Luther returned to Wittenberg to bring under control a reform movement that had become unruly. Luther was basically conservative and preferred to change religious tradition only when he felt the Gospel demanded it. This conservatism angered some of his supporters.

Attempts by Catholic princes to keep people from reading Luther's German New Testament led Luther in 1523 to publish an important work, *On Temporal Authority, To What Extent It Should Be Obeyed.* In this work, Luther argued that God had established two "kingdoms"—a spiritual kingdom and a worldly one. Within the spiritual kingdom, God rules through the Word, or Gospel of Christ. Within the worldly one, He rules through *secular* (nonreligious) authorities. God is lord of both kingdoms, but they must not be mixed. Using this distinction, Luther attacked the papacy for meddling in secular matters, and criticized rebellious peasants during a revolt in 1525 for using the Gospel to support their secular demands.

Also in 1525, Luther published another important work, *The Bondage of the Will,* a reply to *On Free Will* by the great humanist Desiderius Erasmus. In this work, Luther tried to prove that people cannot do anything to contribute to their salvation. They must receive it from God as a gift.

In 1525, Luther married Katherina von Bora, a former Cistercian nun. They had five children, three sons and two daughters.

Building and defending the church. Although Luther had never intended to form a new church, he spent the last 20 years of his life doing just that. In 1529, Luther issued the *Small Catechism,* a work designed to bring Lutheran Christianity to a population largely ignorant of even the basics of Christianity. The following year, Luther's colleague Philipp Melanchthon wrote an important summary of the Lutheran faith to be presented to Emperor Charles V. Known as the *Augsburg Confession,* this summary was meant to show the similarities between Lutheran and Roman Catholic beliefs while defending Lutheran interpretations. In 1534, Luther and his colleagues completed their German translation of the Hebrew Bible, or Old Testament. Luther also lectured regularly, helping the University of Wittenberg prepare the hundreds of new pastors needed to bring the Reformation to the people.

Luther became profoundly disturbed by events in the last years of his life. Everywhere he saw signs that the end of the world was at hand. During this time, Luther issued ferocious attacks against what he thought were the enemies of Christ—the papacy, the Muslim Turks, Protestants whom he considered extremists, and Jews.

Luther's place in history. By the time of his death, Luther was recognized as a major figure in the history of Christianity and the world. He symbolizes the split within western Christianity between Protestants and Roman Catholics. This split has affected the political and cultural development of Europe and North and South America. Luther continues to be the source of some of the most powerful ideas in Christianity. Many reforms adopted by the Roman Catholic Church during the 1960's recall points that Luther had made more than 400 years earlier. One such point involved using the language of the people, rather than Latin, for worship.

Luther's influence extends into other areas as well. His German translation of the Bible helped more than any other single source to form the modern German language. Luther also wrote German hymns—including the

well-known "A Mighty Fortress Is Our God"—and translated Latin hymns into German. His emphasis on singing by the congregation as a part of worship helped shape the development of European music. M. U. Edwards

Related articles in *World Book* include:

Augsburg Confession
Bible (Early English translations)
Eck, Johann
German language (High German)
Hymn (History)
Indulgence
Leo X
Lutherans
Melanchthon, Philipp
Peasants' War
Protestantism
Reformation
Tetzel, Johann
Worms, Edict of
Zwingli, Huldreich

Additional resources

Bainton, Roland H. *Here I Stand: A Life of Martin Luther.* 1950. Reprint. NAL, 1995.
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Lutheran Church in America. See Evangelical Lutheran Church in America.

Lutheran Church—Missouri Synod is one of the largest Lutheran church bodies in the United States. It was organized in 1847 by German immigrants. The standards of faith of the church are based on the Bible and described in detail in the Book of Concord (1580). This book contains the *confessional writings* (expression of beliefs) of Lutheranism.

The church has more than 2 ½ million members and over 6,000 congregations. The church operates 2 seminaries, 10 colleges, and a boarding high school. In addition, its congregations operate about 1,100 elementary schools and 70 high schools. The church has sponsored religious broadcasts since the 1920's and also sponsors television shows seen around the world. The church began missionary work in the 1890's and today has missions in over 30 countries. Headquarters are in St. Louis, Missouri.

Critically reviewed by the Lutheran Church—Missouri Synod

Lutherans make up the largest Protestant denomination in the world. Lutheran churches have about 60 million members. Lutheranism grew out of the Reformation, a religious movement of the 1500's. It is based largely on the doctrines and beliefs of the German reformer Martin Luther. Lutherans also claim to have descended from the ancient Christian tradition. For example, they accept the Apostles, Nicene, and Athanasian creeds of the early church.

Lutherans emphasize congregational participation in the liturgy and have a tradition of hymn singing. Preaching is also an important part of Lutheran worship. Lutherans do not have a unique form of church organization. Bishops, *synods* (representative church councils), congregational government, or a mixture of the three are found in different Lutheran bodies. Lutherans have variety in their worship, but most Lutheran Communion *liturgies* (worship services) generally follow the Roman Catholic Mass.

Doctrine. The teachings of Luther's Reformation set the Lutherans apart from other Christian churches. The best-known statements of Luther's teachings appear in two *catechisms* (formal summaries of beliefs) he wrote in 1529. Lutheran doctrine is also contained in the Augsburg Confession of 1530. All these statements and the three early creeds are included in the Book of Concord (1580). They express the Lutheran belief that God rescues people from sin's control through the life, death, and Resurrection of Jesus Christ. God's forgiveness and acceptance, called *justification,* is solely the gift of God's *grace* (loving kindness) and cannot be earned by religious practices or good deeds. This message of salvation is received through faith and sets the faithful free to serve their neighbors. Lutherans see this message of God's forgiving love as uniquely set forth in the Bible. They believe the Bible is the final authority and basis for the church's teaching.

Two sacraments—baptism and the Lord's Supper—are important parts of Lutheran worship. The Lord's Supper is also called the Sacrament of the Altar, Communion, and the Eucharist.

Lutheran attitudes have been shaped by various historical and cultural forces. Many Lutherans live in Germany and the Scandinavian countries, where Lutheranism has been a state religion under government authority. A traditional tendency among Lutherans toward conformity and restraint on political and social issues may be rooted partly in Martin Luther's opposition to revolutionary disorder. But from the 1500's through the 1900's, Lutherans resisted government attempts to control their doctrine or worship. Lutherans also have helped groups in Europe and South Africa fight for freedom.

Lutheranism in America. Lutherans first settled permanently in the American Colonies during the mid-1600's. Many Lutherans arrived in the 1700's, settling mainly in Pennsylvania. But most of them arrived in the United States in the 1800's. Lutherans came primarily from Denmark, Finland, Germany, Norway, Sweden, and what is now Slovakia. Most of them settled in the Midwest. Today, Lutherans are the fifth largest Christian group in the United States.

Lutheran immigrants usually formed their own ethnic church bodies, but the trend in the 1900's was toward unification. Most Lutherans in the United States belong to one of three synods: the Evangelical Lutheran Church in America, the Lutheran Church—Missouri Synod, or the Wisconsin Evangelical Lutheran Synod. The Evangelical Lutheran Church in America was formed in 1988 by a merger of the American Lutheran Church, the Lutheran Church in America, and the Association of Evangelical Lutheran Churches. Ralph W. Quere

Related articles in *World Book* include:

Augsburg Confession
Evangelical Lutheran Church in America
Luther, Martin
Lutheran Church—Missouri Synod
Protestantism
Reformation

Additional resources

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Luthuli, *loo TOO lee,* **Albert John** (1898-1967), won the 1960 Nobel Peace Prize for his peaceful efforts to end racial segregation in South Africa. Luthuli, a former Zulu chief, led the African National Congress until the government banned it in 1960. In 1959, the government

prohibited him from making speeches and from leaving his home village of Groutville, near Durban. However, he was allowed to go to Norway for his prize.

Bruce Fetter

Lutyens, *LUHCH uhnz* or *LUHT yuhnz,* **Sir Edwin Landseer** (1869-1944), was one of the most important English architects of the early 1900's. His designs show the influence of Palladian Revival and other English architectural styles of the 1700's (see **Architecture** [The Palladian Revival]).

Lutyens first became prominent for country houses he designed with the English landscape architect Gertrude Jekyll. Their best-known country houses included Munstead Wood (1896) near Godalming, Surrey; and Deanery Garden (1901) in Sonning, Berkshire. Later in his career, Lutyens turned to town planning. Two of his most important projects were the village center in Hampstead Garden Suburb, London, and the layout for the city of New Delhi, India. His other works include the Cenotaph war memorial (1920) in London and the British Embassy in Washington, D.C. (1930). Lutyens was born on March 29, 1869, in London. Leland M. Roth

Luxembourg, *LUHK suhm BURG,* is one of Europe's oldest and smallest independent countries. It lies in northwestern Europe where Germany, France, and Belgium meet.

Luxembourg has scenic areas of rolling hills and dense forests. Whitewashed houses in towns and villages cluster around medieval castles and churches. Luxembourg is also highly industrialized. Most industries are located in the southwest part of the country.

Luxembourg was established as an independent state in 963. Its official name is Grand-Duché de Luxembourg in French and Grossherzogtum Luxemburg in German (Grand Duchy of Luxembourg). The city of Luxembourg is the country's capital and largest city.

Government. Luxembourg is a constitutional monarchy. The grand duke (or duchess) of the House of Nassau serves as monarch and the country's chief executive. The monarchy passes to the oldest son or daughter of the monarch. A 64-member parliament called the Chamber of Deputies makes Luxembourg's laws. The people elect the members to five-year terms.

The monarch appoints a prime minister and 10 other Cabinet ministers to carry out the operations of the government. The Cabinet members must have the support of a majority of the members of parliament. The monarch also appoints for life a 21-member advisory body called the Council of State.

Luxembourg is divided into three districts, each headed by a commissioner appointed by the national government. The districts are divided into 12 cantons, and the cantons are divided into communes. Elected officials head the cantons and communes.

People. Luxembourgers have close cultural ties with neighboring Belgium, France, and Germany. However, they maintain an independent spirit, as expressed in words of their national anthem, *"Mir welle bleiwe wat mir sin"* ("We want to remain what we are").

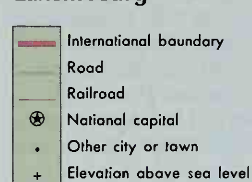
Most Luxembourgers have better food and housing than many other Europeans have. The country has extensive government social security and health care benefits. Luxembourg's high standard of living attracts people from other parts of Europe. Approximately one-third of Luxembourg's population are immigrants.

Pork and freshwater fish, especially trout, are favorite Luxembourg foods. Beer and wine are popular beverages. Many people live in charming villages where buildings constructed in the 1900's stand beside those dating from the 1100's, 1300's, and 1700's. The cities have many modern office and apartment buildings.

Facts in brief

Capital: Luxembourg.
Languages: *Official*—French, German, Letzeburgesch.
Form of government: Constitutional monarchy.
Area: 998 mi² (2,586 km²). *Greatest distances*—north-south, 55 mi (89 km); east-west, 35 mi (56 km).
Elevation: *Highest*—Buurgplatz, 1,835 ft (559 m) above sea level, in the Ardennes Mountains. *Lowest*—435 ft (133 m) above sea level on the Moselle River.
Population: *Estimated 2002 population*—438,000; density, 439 per mi² (169 per km²); distribution, 88 percent urban, 12 percent rural. *1991 census*—384,634.
Chief products: *Agriculture*—barley, grapes, oats, potatoes, wheat, livestock. *Manufacturing*—steel, chemicals, plastics, tires, wine, food processing.
National anthem: "Ons Hemecht" ("Our Homeland").
Flag: The flag has horizontal red, white, and blue stripes (top to bottom). The colors come from the coat of arms of Luxembourg. Adopted 1845. See **Flag** (picture: Flags of Europe).
Money: *Basic unit*—euro. One hundred cents equal one euro. The franc was taken out of circulation in 2002.

Luxembourg







WORLD BOOK maps



Cameramann International Ltd., from Marilyn Gartman

The city of Luxembourg is the capital and largest city of Luxembourg. The city lies on steep cliffs overlooking the Alzette and Petrusse rivers.

Luxembourg has three official languages: French, German, and Letzeburgesch. Letzeburgesch, a *dialect* (local form) of German, is a widely used everyday language. German is used in most elementary schools, and French is used in most high schools. Newspapers are printed in German. French is used in the courts and parliament. Nearly all Luxembourgers are Roman Catholics.

The law requires children between the ages of 6 and 15 to attend school. Luxembourg has an International University of Comparative Science and several technical and vocational schools. Almost all adult Luxembourgers can read and write.

Land. Luxembourg has two distinct land regions, the Ardennes and the Bon Pays (Good Land). The Ardennes cover the northern third of Luxembourg, and the Bon Pays makes up the rest. The Ardennes are part of a mountain system that extends from Germany's Rhineland into Belgium and Luxembourg. River valleys cut through the region's low hills. Buurgplatz (1,835 feet, or 559 meters), a hill in the Ardennes, is Luxembourg's highest point. Most of the Bon Pays is a hilly or rolling plateau with level areas along its rivers. The Attert, Alzette, Moselle, and Sûre rivers flow through the region. The Bon Pays is an important farming region.

Most of Luxembourg has a cool, moist climate. The average temperature in the city of Luxembourg is about 32 °F (0 °C) in January and about 63 °F (17 °C) in July. Rainfall varies from about 40 inches (100 centimeters) a year in southwestern Luxembourg to from 12 to 16 inches (30 to 41 centimeters) a year in the southeast. Most snowfalls occur high in the Ardennes.

Economy. Luxembourg is one of Europe's leading steel producers. Its largest employer is a steel company, Aciéries Reüniès de Burbach-Eich-Dudelange, better known as ARBED. Since World War II (1939-1945)—and especially since the general decline of steel production in the 1970's—the government has worked to add variety to the economy.

Luxembourg now has a number of high technology industries, which produce such goods as computers and other electronic equipment. Many foreign companies operate factories that make such products as chemicals, plastics, and tires. Numerous foreign banks have offices in the country. Tourism is also a major industry.

Farmers in the Bon Pays region raise barley, oats, potatoes, and wheat. They also raise pigs and poultry and tend herds of cattle and sheep. Grapes grown on terraces along the Moselle River produce good wine. Although about half of the total land is farmed, only 6 percent of Luxembourg's workers are farmers.

Luxembourg is a member of the European Union, and trades chiefly with other members. Steel products are the country's leading export. The chief imports are food and machinery.

Luxembourg has about 3,200 miles (5,100 kilometers) of roads. Its 170 miles (270 kilometers) of railroads connect eastern France with Belgium. A major international airport is located just outside the capital.

History. Luxembourg was established as an independent state in 963, when Siegfried, count of Ardennes, gained control of the area and built a castle on the site of the present-day city of Luxembourg. In 1308, Henry VII, count of Luxembourg, became emperor of the Holy Roman Empire. His grandson, Charles IV, created the Duchy of Luxembourg in 1354.

Philip the Good of Burgundy conquered Luxembourg in 1443. In 1684, France took control of Luxembourg. Luxembourg became part of Spain in 1697. Austria gained control of it in 1714. In 1795, Luxembourg again became part of France.

In 1815, after the defeat of Emperor Napoleon I of France, the Congress of Vienna made Luxembourg a grand duchy that was technically ruled by the Netherlands. But Luxembourg was largely self-governing. In 1890, Wilhelmina became queen of the Netherlands. Luxembourg then broke away from the Netherlands and named its own monarch, because the grand duchy's laws did not allow a woman to rule. In 1912, the laws were changed to allow Marie Adélaïde of Nassau to become the ruling grand duchess. Her sister Charlotte succeeded her in 1919.

Germany occupied Luxembourg during parts of World War I (1914-1918) and World War II (1939-1945). In the winter of 1944 and 1945, part of the Battle of the Bulge was fought in northern Luxembourg. Thousands of Americans killed in that battle are buried in Hamm.

In 1945, Luxembourg became a member of the United Nations (UN). It joined an economic union called Benelux in 1948, and became a member of the North Atlantic Treaty Organization (NATO) in 1949.

In the 1950's, Luxembourg helped found several European economic groups. These groups became the basis of the European Community (EC), an economic association of European nations. In 1964, Charlotte abdicated to allow her son Prince Jean to become grand duke.

In 1993, Luxembourg and the other EC countries formed the European Union, which works for both economic and political cooperation among its member nations. The EC was incorporated into the European Union.

Today, Luxembourg plays an important role in European matters. The city of Luxembourg is the seat of several agencies of the European Union, including the *secretariat* (administrative staff) of the European Parliament

and the European Court of Justice.

In 2000, Jean stepped down from the throne. His son Prince Henri became grand duke. Janet L. Polasky

Related articles in *World Book* include:

Benelux
Christmas (In the Netherlands, Belgium, and Luxembourg)
Europe, Council of
European Union
Luxembourg (city)

Luxembourg (pop. 75,377) is the capital and largest city of the country of Luxembourg. For location, see **Luxembourg** (country [map]). A picturesque city, Luxembourg stands on a plateau high above gorges formed by the Alzette and Petrusse rivers. Its landmarks include the Grand Ducal Palace, which was built in the 1500's; the Gothic Cathedral of Notre Dame, which dates from the early 1600's; and the town hall, which was built in the early 1800's. The Grand Ducal Palace is the home of the country's monarch.

Luxembourg is the seat of several agencies of the European Union, including the European Court of Justice and the *secretariat* (administrative staff) of the European Parliament. The city is also an international financial center. Many foreign banks have offices there.

Roman soldiers began constructing a fort at what is now Luxembourg in the A.D. 300's. In 963, Siegfried, Count of Ardennes, built a castle there, and a walled town grew up around the castle. Through the years, the walls were strengthened for defense against attacks. Gradually, much of the castle was destroyed. The walls were largely dismantled in the mid-1800's. But some parts still stand. Janet L. Polasky

See also **Luxembourg** (country [picture: The city of Luxembourg]).

Luxemburg, *LUHK suhm BURG,* **Rosa** (1871-1919), was a German socialist writer and revolutionary. She was a follower of Karl Marx, the founder of revolutionary Communism.

Luxemburg was born in Zamość, Poland, and became acquainted with Marx's writings after graduating from high school. At the age of 18, she fled to Switzerland to avoid arrest for political activities. Luxemburg received a doctorate in economics from the University of Zurich in 1898. That same year, she moved to Germany and joined the German Social Democratic Party. She became known as a brilliant writer and speaker.

Luxemburg spent most of the period of World War I (1914-1918) in prison for antiwar activities. She was released briefly in 1916. During this period, Luxemburg helped establish the Spartacus Party, a more revolutionary wing of the Social Democratic Party. The Spartacus Party was named after the leader of a slave uprising in ancient Rome. In 1918, Luxemburg helped found the German Communist Party and its newspaper, *Rote Fahne* (*Red Flag*). She was killed in Berlin during a workers' revolt against the government. June Sochen

Luxor. See **Thebes; Obelisk.**

Luzern. See **Lucerne.**

Lvov, *luh VAWF* (pop. 798,000), is a major city of Ukraine. It is called *Lviv* in Ukrainian. The city is an administrative, commercial, industrial, and cultural center of western Ukraine. Lvov also is a major transportation hub. For location, see **Ukraine** (political map).

Lvov's major products include agricultural machinery, chemicals, electrical equipment, heavy vehicles, processed foods, and refined petroleum. Lvov has many museums, libraries, research institutes, and schools of higher education. The Lvov State University was established in 1611.

Lev, ruler of the independent principality of Galicia, founded Lvov in the 1200's (see **Galicia**). Poland controlled the city—spelled *Lwów* by the Poles—from the 1340's until 1772. From 1772 to 1918, Austria ruled Lvov. Austria renamed the city *Lemberg.* Poland retook the city after World War I ended in 1918. Lvov officially became part of the Ukrainian republic of the Soviet Union in 1945, after World War II ended. In 1991, Ukraine and other republics of the Soviet Union declared their independence, and the Soviet Union ceased to exist.

Leszek A. Kosiński

Lycanthropy. See **Werewolf.**

Lycée. See **France** (Education).

Lyceum, *ly SEE uhm,* is an organization that sponsors lectures, concerts, and other adult educational programs. The name comes from the school of Aristotle in Athens (see **Lyceum** [school]).

Josiah Holbrook began the American lyceum movement in 1826 in Millbury, Massachusetts. The early lyceum movement attempted to improve schools, bring about better teacher preparation, establish libraries and museums, and improve American culture. The Chautauqua movement and universities took over most of the lyceum's work during the late 1800's (see **Chautauqua**).

Gerald L. Gutek

Lyceum, *ly SEE uhm,* was a school founded by the Greek philosopher Aristotle in 335 B.C. It was located outside the walls of Athens along the Ilissus River. It stood near Athens, in a grove sacred to the god Apollo Lykeios (also spelled *Lyceius*), for whom it was named. Students and teachers at the Lyceum pursued higher learning through lectures, discussions, and research. The Lyceum had one of the world's first libraries and one of the first natural history museums. Aristotle and his followers and students lived at the Lyceum. Aristotle's followers became known as the *Peripatetics,* probably after a covered walk (*peripatos*) attached to one of the Lyceum buildings. Ronald P. Legon

Lycopodium. See **Club moss.**

Lycurgus, *ly KUR guhs,* was a Spartan legislator. He is said to have set up the government that made Sparta the great military power of the Greek states (see **Sparta**). His birth and death dates and his exact achievements are uncertain. Lycurgus probably lived during the 800's B.C., and was a member of one of the two Spartan royal families. The stories about him say he traveled to other parts of Greece, and to Asia and Egypt, to study their laws. On his return, he was asked to develop a new form of government for Sparta.

Lycurgus's greatest achievements were his economic and social reforms. He redistributed the land and banned money from Sparta, thus supposedly making all citizens equal. But control of Sparta remained in the hands of only a few of its citizens. In the social system devised by Lycurgus, strict supervision from birth enforced discipline and military training. Linda J. Piper

Lydia, *LIHD ee uh,* was a country in ancient Asia Minor. It was famous for its fertile soil and its rich mineral deposits, especially the gold of the River Pactolus. In the early 500's B.C., Lydia was an independent and prosperous kingdom. In about 545 B.C., the Persians conquered



WORLD BOOK map

Location of Lydia

Croesus, the last king of the Lydians. Later, Lydia fell to the Macedonians and the Romans. Because Lydia lay at the western end of the road connecting Mesopotamia and the East with the Aegean Sea and Greece, it was a great commercial center. Lydia was one of the first countries to cast coins. Since 1958, archaeologists have been excavating Sardis, the capital city of Lydia. They have found sculpture and other artifacts, a synagogue, and a gymnasium complex. See also **Croesus; Cyrus the Great; Money** (The first coins); **Phrygia.** Norman Yoffee

Lye, also called *caustic soda,* is an important industrial chemical. It serves as the main ingredient in many commercial drain cleaners and oven cleaners. It is also used in the manufacture of soap and paper.

Lye is a solid, white material that readily absorbs moisture. It produces extremely corrosive solutions. Lye, both as a solid and in solution, can severely damage skin if it comes into contact with it. If splashed into eyes, lye solution can cause blindness in a few seconds.

Lye is produced from brine by *electrolysis* (see **Electrolysis**). The chemical name for lye is *sodium hydroxide.* Its chemical formula is $NaOH$. Robert J. Ouellette

See also **Alkali.**

Lyell, *LY uhl,* **Sir Charles** (1797-1875), was a British geologist whose writings established *uniformitarianism* as the basis of modern geology. Uniformitarianism is the theory that the gradual processes shaping the earth today, such as erosion, also formed the earth's features in the past. James Hutton, a Scottish geologist, had introduced this theory in 1785. In Lyell's day, however, most scientists still believed the earth had been shaped by rare and sudden events that were unique to the past.

Lyell convincingly set forth the theory of uniformitarianism in his three-volume work *Principles of Geology* (1830-1833). He stated that most of the earth's structural features could be explained as the result of constantly occurring processes over millions of years. Lyell supported his theory by analyzing the long-term effect of observable events, such as the erosion of land by rivers. Lyell was born at Kinnordy, near Kirriemuir, Scotland. Dennis R. Dean

See also **Geology** (Experimental geology).

Lyly, *LIHL ee,* **John** (1554?-1606), was an English writer. He was important in the history of prose style and the development of Elizabethan popular comedy of high literary quality. Lyly was born in Canterbury. He established his literary reputation with *Euphues: The Anatomy of Wit* (1578), a fashionable book combining essay and fiction. Its artificial style, called *euphuism,* set a new pattern for sophisticated English prose.

Lyly turned to playwriting as part of an unsuccessful effort to further his advancement at court. His comedies treat idealized love and flatteringly reflect attitudes of the Elizabethan courtier. Written to be performed by troupes of boy actors, they emphasize style, song, and witty dialogue. *Campaspe* (1584) and *Endymion* (1588) are typical of Lyly's plays. Shakespeare's romantic comedies show the influence of Lyly's work. Stephen Orgel

Lyme disease is a bacterial infection transmitted by certain ticks. The disease is caused by *Borrelia burgdorferi,* a bacterium that infects several species of ticks found in woodlands, brushy areas, and coastal grasslands. These ticks also are carried on the bodies of certain animals, especially white-tailed deer and white-footed field mice. People get Lyme disease after being bitten by an infected tick. The tick must remain attached for at least 36 hours for infection to occur. The disease is most commonly transmitted during the summer.

The symptoms of Lyme disease vary in type and severity. In most people, the first sign of infection is a rash. It spreads from the site of the tick bite two days to two weeks after the bite. The surest way to diagnose Lyme disease is to see the rash. However, more than a fourth of the people infected do not develop one. Other early symptoms include fever, headache, fatigue, and pain in the muscles and joints. Physicians use antibiotics to treat Lyme disease. When the illness is diagnosed and treated early, most patients make a full recovery. If untreated, the disease can lead to arthritis, heart abnormalities, and disorders of the nervous system.

People can reduce their risk of getting Lyme disease by taking precautions against ticks that transmit it. In woody or brushy areas, people should inspect their skin daily for ticks and remove them promptly. It also helps to wear long-sleeved shirts and long pants tucked into socks, and to use insect repellent. A vaccine that provides some protection against Lyme disease is available.

Lyme disease occurs in many parts of the world, including Africa, Asia, Australia, and Europe. In the United States, it is most common in the Northeast, in Minnesota, and in California. The disease gets its name from the town of Lyme, Connecticut, where a cluster of cases occurred in the early 1970's. Raymond J. Dattwyler

See also **Deer tick.**

Lymphatic system, *lihm FAT ihk,* is a network of small vessels that resemble blood vessels. The lymphatic system returns fluid from body tissues to the bloodstream. This process is necessary because the body continuously filters water, proteins, and other molecules out of tiny blood vessels called *capillaries.* The fluid that has leaked out, called *interstitial fluid,* bathes and nourishes body tissues.

If there were no way for excess interstitial fluid to return to the blood, tissues would become swollen. Some of the extra fluid seeps into capillaries that have low fluid pressure. The rest returns by way of the lymphatic system and is called *lymph.* Some scientists consider the lymphatic system to be part of the circulatory system because lymph comes from blood and returns to blood.

The lymphatic system also is one of the body's defenses against infection. Harmful particles and bacteria that have entered the body are filtered out by small masses of tissue that lie along the lymphatic vessels. These bean-shaped masses are called *lymph nodes.*

Parts of the lymphatic system

Lymphatic vessels, like blood vessels, are found throughout the body. Most organs, including the heart, lungs, intestines, liver, and skin have lymphatic vessels. The brain, however, has no lymphatic vessels.

Lymph flows from tiny vessels with many branches into larger vessels. Eventually, lymph from all but the upper right quarter of the body reaches the *thoracic duct,* the largest lymphatic vessel. The thoracic duct lies along the front of the spine. Lymph flows upward through this duct into a blood vessel near the junction of the neck and the left shoulder. Lymph from the upper right quarter of the body flows into the *right lymphatic ducts* in the right half of the chest. The lymph then drains from these ducts into the bloodstream near the junction of the neck and right shoulder.

Lymph is chemically much like plasma, the liquid in which blood cells are suspended. But lymph contains only about half as much protein as plasma, because large protein molecules do not seep through blood vessel walls so easily as do some other substances. Lymph is transparent and straw-colored.

Lymph nodes may be found at many places along the lymphatic vessels. They look like bumps and have diameters from $\frac{1}{25}$ to 1 inch (1 to 25 millimeters). The term *node* comes from the Latin word *nodus,* meaning *knot,* and lymph nodes resemble knots in a "string" of lymphatic vessels. The nodes are bunched together in certain areas, especially in the neck and armpits, above the groin, and near various organs and large blood vessels. Lymph nodes contain large cells called *macrophages* that absorb harmful matter and dead tissue.

Lymphocytes are a kind of white blood cell present in the lymph nodes. They defend the body against infection. When abnormal cells or materials from outside the body pass into the lymph nodes, lymphocytes in the nodes produce substances called *antibodies.* The antibodies either destroy the abnormal or foreign matter or make it harmless. See **Immune system.**

Large numbers of lymphocytes are found in the lymph nodes and in lymph itself. They outnumber all other kinds of cells in lymph.

Lymphoid tissue resembles the tissue of the lymph nodes. It is found in some parts of the body that are not generally considered part of the lymphatic system. For example, the adenoids and tonsils, the spleen, and the thymus consist of lymphoid tissue. This tissue produces and contains lymphocytes, and it aids in the body's defense against infection.

Work of the lymphatic system

Return of interstitial fluid. Interstitial fluid is produced continuously by seepage from the capillaries. For this reason, some of the fluid must constantly be returned from body tissues to the bloodstream. If the lymphatic vessels are blocked, fluid gathers in nearby tissues and causes swelling called *edema.*

Lymph only flows in one direction—toward the tho-

The lymphatic system

WORLD BOOK illustrations by Lou Bory Associates

The lymphatic system consists of a network of vessels throughout the body. Lymph nodes are found at various places along these vessels. Some nodes and vessels lie deep within the body, and others lie near the skin.

Lymph forms from fluid that seeps out of capillaries. The lymphatic vessels carry the lymph to the thoracic duct, which empties into a vein near the heart, *left.* The illustration above shows the movement of lymph through a lymph node.

racic duct. Valves along the lymphatic channels prevent the lymph from flowing backward. The larger lymphatic vessels have a thin layer of muscle in their walls. Contraction of these muscles propels lymph through the lymph channels. In this way, lymph can be transported upward, against gravity, toward the thoracic duct. The smallest lymphatic vessels have no muscle of their own. Expansion and compression of these vessels result from movement of surrounding tissue. Thus, lymph flow is caused by breathing, by the pulsebeat in nearby blood vessels, by muscular and intestinal movement, and by skin massage.

Fighting infection. Lymphocytes and macrophages both play vital roles in fighting infection—lymphocytes by producing antibodies and macrophages by swallowing up foreign particles. During an infection, the lymph nodes that drain an infected area may swell and become painful. The swelling indicates that the lymphocytes and macrophages in the lymph nodes are fighting the infection and working to stop it from spreading. Such swellings are often called "swollen glands," though lymph nodes—not glands—are swollen.

Lymphocytes also flow into the bloodstream and circulate throughout the body combating infection. Many lymphocytes find their way to areas just under the skin. There, they produce antibodies against bacteria and various substances that cause allergies.

Absorption of fats. Lymphatic vessels in the wall of the intestine help the body absorb fat. These vessels are called *lacteals.* In the intestine, digested fats combine with certain proteins. The resulting particles enter the lacteals and give the lymph there a milky-white color. This milky-white lymph is called *chyle.* The chyle passes through the lacteals to the *cisterna chyli,* an enlarged area in the lower part of the thoracic duct. Then the chyle and other lymph fluids flow through the thoracic duct into the bloodstream. Absorption of fats thus differs from that of carbohydrates and proteins, which blood vessels absorb and transport to the liver.

Rejection of transplanted tissue. Lymphocytes also take part in the body's rejection of tissue that has been transplanted from one person to another. They react against transplanted tissue in the same way that they do against other foreign material—by producing antibodies. After a person has received a transplanted organ, doctors reduce antibody production by destroying lymphocytes. However, this destruction of the lymphocytes reduces the patient's ability to fight infection.

Geert W. Schmid-Schoenbein

See also **Blood; Elephantiasis; Hodgkin's disease.**

Lynch, Thomas, Jr. (1749-1779), was a South Carolina signer of the Declaration of Independence. He served in South Carolina's first General Assembly and in the Second Continental Congress. Lynch was born near Georgetown, South Carolina. He graduated from Cambridge University and then studied law in London. In 1775, while he was serving in the Revolutionary War in America, a severe illness left him a semi-invalid. In 1779, during a voyage to the West Indies, Lynch and his wife were lost at sea. Gary D. Hermalyn

Lynching usually means the killing, generally by hanging, of a person by a mob in defiance of law and order. Victims of a lynching do not have a chance to defend themselves. The mob assumes its victims are guilty, whether or not the victims have had a trial. Lynch mobs not only promote disrespect for law, order, and basic human rights, but they also encourage mass brutality.

Most states have attempted to stop lynchings by laws. Some states prosecute under the laws against homicide, riot, and assault. Other states have specific lynch laws. But legal controls have not succeeded in preventing lynchings. One of the problems is the difficulty in picking out the leaders of the mob. Another problem is the lack of jury convictions, even with evidence. The decline in lynching in the United States is due primarily to increased public opinion against mob violence.

The term *lynching* probably originated with Charles Lynch, a planter who lived in Virginia during the 1700's. Lynch and his neighbors took the law into their own hands and punished *Tories* (British sympathizers) and others who plundered their property. The term came to be applied to physical punishment, such as whipping and tarring and feathering.

In pioneer communities on the far western frontier, many lynch mobs punished people for horse stealing, highway robbery, or murder. Lynchings began to take the form of hangings. People took the law into their own hands because there was no duly established legal authority. With the establishment of law and order throughout the United States, lynch mobs began to act in opposition to the law, instead of supporting it.

Before 1890, most lynching victims were white. Since then, most lynchings have occurred in the South, and most of the victims have been blacks. About 4,800 known lynchings occurred from 1882 to 1968. Of those, about 25 percent were against whites and about 70 percent were against blacks. The peak year for these killings was 1892, with about 230 victims. From 1957 to 1968, there were seven lynchings. No recorded lynchings have taken place since 1968. Franklin E. Zimring

See also **Wells-Barnett, Ida Bell.**

Lyndon B. Johnson Space Center. See Johnson Space Center.

Lynen, Feodor (1911-1979), a German biochemist, studied how cells produce cholesterol and other fatty substances known as *lipids.* High levels of certain cholesterol-containing molecules in the blood are a main cause of heart disease. Medical researchers have used results of Lynen's work to help prevent heart disease.

Lynen's experiments revealed the roles of certain *enzymes* (molecules that speed up chemical reactions) and the vitamin biotin in the formation of lipids. For this work, Lynen shared the 1964 Nobel Prize for physiology or medicine with Konrad Bloch, an American biochemist. Lynen was born in Munich. Martin D. Saltzman

Lynn, James Thomas (1927-), served as U.S. secretary of housing and urban development from 1973 to 1975. From 1975 to 1977, he served as director of the Office of Management and Budget under President Gerald R. Ford.

Lynn was born in Cleveland. He graduated from Western Reserve (now Case Western Reserve) University in 1948 and from Harvard Law School in 1951. He then joined Cleveland's largest law firm. In 1969, Lynn was named general counsel of the U.S. Department of Commerce. He was appointed undersecretary of commerce in 1971. Charles Bartlett



Hans Reinhard, Bruce Coleman Ltd.

The Eurasian lynx, like the other lynxes, is a powerfully built wild cat with tufted ears.

Lynx, *lihngks,* is the name of three kinds of wild cats with sturdy bodies. Lynxes live in parts of Asia, Europe, and North America. The *Canadian lynx* ranges across thick forests in Canada and the northern United States. The *Eurasian lynx* lives in forests of Europe and northern Asia and in open or scrub woodlands of central Asia. The *Iberian lynx,* also called the *Spanish lynx,* is one of the world's most endangered animals. It inhabits scattered woodland areas in Portugal and Spain.

Adult lynxes weigh on average from 20 to 45 pounds (9 to 20 kilograms), considerably larger than most house cats. The Eurasian lynx ranks as the largest of the three species. The Iberian lynx is the smallest. Lynx fur is basically grayish in color, but it also can be yellowish or rust-colored. Most lynxes have black spots covering their bodies. However, these spots are not always clearly visible. The cats possess long tufts of hair on the tips of their pointed ears and ruffs of hair around the sides of their faces. They also have short, black-tipped tails. Large, fur-covered paws serve as snowshoes and enable lynxes to move easily in deep snow.

Lynxes generally sleep during the day and hunt at night. They feed on such animals as rabbits, hares, birds, and occasionally deer. Male and female lynxes mate in late winter or early spring. The female carries the young within her body for about 70 days. She then gives birth to from one to four kittens. The young stay with their mother for about 10 months. Elizabeth S. Frank

Scientific classification. Lynxes belong to the cat family, Felidae. The scientific name for the Canadian lynx is *Lynx canadensis.* The Eurasian lynx is *L. lynx,* and the Iberian lynx is *L. pardinus.*

See also **Bobcat; Caracal; Wildcat.**

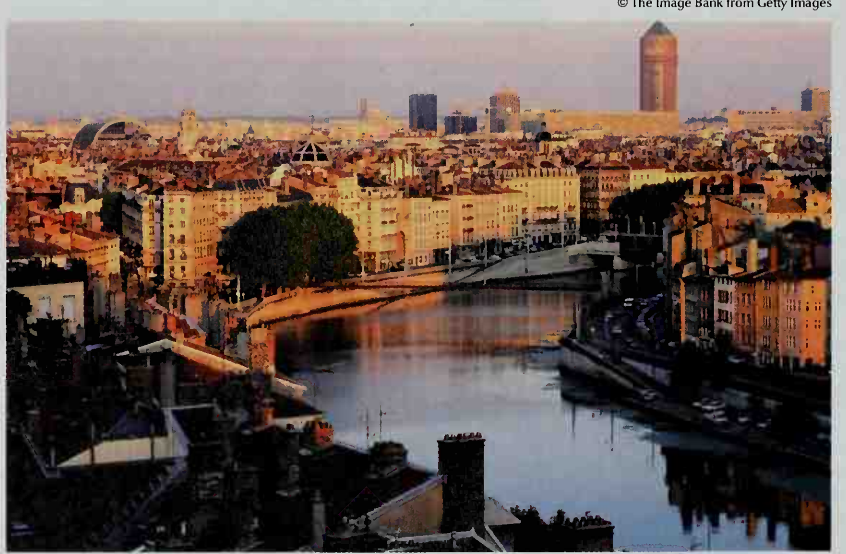
Lyon, *lyawn* (pop. 453,187; met. area pop. 1,348,832), is France's third largest city. Only Paris and Marseille have more people. Lyon's metropolitan area also ranks second in population to that of Paris. Lyon lies in southeastern France (see **France** [political map]). The city serves as the capital of the Rhône *department* (administrative district) and of the Rhône-Alpes region.

The Rhône and Saône rivers meet at Lyon. They divide the city into three parts—the west bank of the Saône, the peninsula between the two rivers, and the east bank of the Rhône. Docks and warehouses line the riverfront.

The district of Vieux (Old) Lyon on the west bank of the Saône has many beautiful buildings that date from the Renaissance (the late 1400's to early 1600's) or earlier. The Cathedral of St. Jean, built between the late 1100's and about 1480, is one of the landmarks of the district.

Lyon's main commercial and entertainment district lies on the peninsula between the two rivers. The Church of St. Martin d'Ainey, much of which dates from the 1100's, was built in this district. The Croix-Rousse neighborhood stands just north of the peninsula. Its towering houses date from the 1800's, when Lyon was a global center of silk production. Skilled weavers lived in

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Lyon is one of the largest cities in France. The Rhône River, *shown here,* and the Saône River meet at Lyon and divide the city into three parts—the west bank of the Saône, the peninsula between the two rivers, and the east bank of the Rhône. The Tour du Crédit Lyonnais, a high-rise office building, rises in the background.

these houses, which were built with high ceilings to hold the huge Jacquard looms the weavers used.

The newest area of Lyon is on the east bank of the Rhône. It includes factories, a large university complex, and many attractive residences.

Lyon is famous for the production of textiles, especially silk and rayon. Textile, chemical, automobile, and metal goods plants are concentrated in the surrounding suburbs. Lyon is a major center for medical and scientific research. The area is also known for its wines and cheeses. High-speed trains called *trains de grande vitesse*, or *TGV*, link Lyon to Paris and Marseille.

In 43 B.C., Roman soldiers established a colony on the site of what is now Lyon. The town served as an important administrative center of the Roman Empire until the middle of the A.D. 200's. Lyon became part of the kingdom of France in the early 1300's. During the 1400's, the city became a prosperous trading and banking center and home to many book printers. The introduction of silk manufacturing from Italy in the 1500's brought greater, and long-lasting, prosperity. Lyon was a center of French resistance to German occupation forces during World War II (1939-1945). William M. Reddy

Lyon, *LY uhn,* **Mary** (1797-1849), pioneered in providing higher education for women. She founded Mount Holyoke College, which opened as Mount Holyoke Female Seminary in 1837. Lyon also served as its president until her death. She aimed, through educational opportunities, to help young women develop their abilities and talents and to use them in service to others. Lyon was born on Feb. 28, 1797, in Buckland, Massachusetts. She died on March 5, 1849. Glenn Smith

Lyra, *LY ruh,* also called the Harp, is a small constellation that can be seen from the Northern Hemisphere. Its brightest star, Vega, is about 26 light-years from the earth. One light-year equals 5.88 trillion miles (9.46 trillion kilometers). Vega is the fifth brightest star visible, excluding the sun.

Lyra has two notable features that can be seen through a small telescope. One of them is Epsilon Lyrae, which appears to be a double star. But, when viewed through a telescope, each of the two stars is seen to be a *binary star* (pair of stars that orbit each other). When viewed through a telescope, each of these bright stars in turn is double. A telescope also can spot the *Ring Nebula,* a ring-shaped cloud of dust and gas surrounding a very faint star. The nebula formed when the star blew off an outer layer of its atmosphere. David H. Levy

See also **Astronomy** (map: The stars and constellations of the Northern Hemisphere).

Lyre, *lyr,* is an ancient stringed musical instrument that resembles a small harp. It has a bowl- or box-shaped frame with two arms extending upward. A crossbar is attached to the top of the arms. The instrument has 4 to 10 strings, which extend from the crossbar to the base of the frame. The player plucks the strings with the fingers of one hand or with a *plectrum* (pick). The fingers of the other hand press down on the strings to set the required pitch. In Europe, some types of lyres are played with a bow instead of by plucking the strings. The sound of a lyre is amplified by a piece of cattle skin stretched tightly across the open side of the frame.

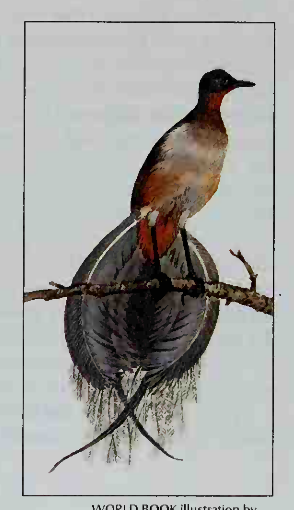
The lyre was especially popular among the ancient Greeks. The instrument was the symbol of Apollo, the Greek god of music and poetry. The Greeks used the lyre to accompany their songs and recitations. The words *lyric* and *lyrical* come from this use of the instrument. Abram Loft



Red figure terra-cotta vase; The Metropolitan Museum of Art, Fletcher Fund, 1956

A boy playing a lyre was painted on a Greek vase of about 490 B.C. The lyre was a popular instrument in ancient Greece. It was the symbol of the god Apollo, patron of musicians and poets.

Lyrebird, *LYR burd,* is one of the most unusual Australian birds. The male's tail has large and spreading feathers arranged like the ancient lyre. Two broad feathers curve upward with slender feathers in between. Normally, the tail is carried low. When the tail is raised and arched, it is about 2 feet (60 centimeters) long. Sometimes the tail is arched forward over the top of the bird's head. The lyrebird itself is only about the size of a chicken. The tail does not reach full growth until the bird is 7 or 8 years old.



WORLD BOOK illustration by Trevor Boyer, Linden Artists Ltd.

Lyrebird

The lyrebird has brown plumage. These birds have a strong, melodious song, and they can imitate the songs of other birds with remarkable accuracy. The lyrebird can fly, but it uses its wings chiefly when running and leaping. It makes its nest on the ground, and the female lays one egg in it. John W. Fitzpatrick

Scientific classification. Lyrebirds belong to the lyrebird family, Menuridae. There are two species, *Menura novaehollandiae* and *M. alberti.*

Lyric poetry. See Poetry (Lyric poetry); **Greek literature** (Lyric poetry).

Lysander, *ly SAN duhr* (? -395 B.C.), was a statesman and general of the ancient Greek city-state of Sparta. He commanded Spartan forces late in the Peloponnesian War between Sparta and Athens. Lysander got Persia to help build and support a Spartan fleet. In 405 B.C., he commanded the final battle of the war at Aegospotami. In this famous battle, the new Spartan fleet destroyed the superior Athenian navy.

In charge of Sparta's foreign policy, Lysander established the government of Thirty Tyrants to rule Athens after the war. He also helped set up *decarchies,* boards of 10 that ruled in Greek states Sparta had won from Athens.

Continued success made Lysander haughty and insolent. He tried to make Sparta's two kings, who inherited their thrones, gain office by election. However, he was unsuccessful. Lysander was killed in a war against Corinth when one of Sparta's kings deliberately failed to arrive in time to support Lysander and his troops.

Linda J. Piper

Lysenko, *lih SEHNG koh,* **Trofim Denisovich,** *trah FEEM deh NEE sah vihch* (1898-1976), was the most important biologist in the Soviet Union from the mid-1930's to the late 1950's. Soviet dictator Joseph Stalin supported Lysenko's theories for improving farm production because they promised quick success. However, Lysenko's theories did not lead to agricultural improvements, and later Soviet leaders blamed them for slowing the growth of the country's agriculture. Lysenko held back Soviet research in *genetics* (the science of heredity) for more than 20 years.

Lysenko believed that new species of crops could be created from the old species by altering the crops' *environment* (surroundings). The resulting changes would be passed to the next generation, and create improved breeds, better adjusted to the conditions of their environment. Lysenko said, in effect, that organisms could be "trained" to change. He rejected the idea that units called *genes* determine heredity. His ideas have been rejected by present-day biologists.

Lysenko was born in September 1898 in Karlovka, a village near Poltava. His parents were farmers. He died on Nov. 20, 1976. Keith R. Benson

Lysergic acid diethylamide. See LSD.

Lysias, *LIHS ee uhs* (459?-380? B.C.), was a great orator of ancient Greece. He wrote more than 200 speeches and helped establish the study of oratory.

Lysias was born in the Greek colony of Syracuse in Sicily. His father was a wealthy shield manufacturer. Lysias moved to Athens in Greece and became a strong supporter of that city's democratic government.

Nearby Sparta conquered Athens in the Peloponnesian War (431-404 B.C.). The Spartans installed a powerful group of men, known as the Thirty Tyrants, to govern Athens. Lysias was arrested by the government because of his wealth and democratic beliefs, but he escaped into exile.

Lysias returned to Athens when democracy was restored in 403 B.C. In that same year, Lysias attacked the cruelty and corruption of the Thirty Tyrants in his famous speech "Against Eratosthenes." Donald Kagan

Lysippus, *ly SIHP uhs* (380's?-306? B.C.), revolutionized sculpture in ancient Greece. None of his work has survived, but many works are known from copies and written accounts. Lysippus was famous for his bronze statues of athletes, gods, and heroes. He created figures that seemed to turn and extend their arms into space, forcing the viewer to walk around the sculptures to see it from all sides. His figures expressed emotion, and ancient writers said that his statues inspired fear and reverence. Lysippus reintroduced sculpture in which the figures are many times larger than life-sized. He also created allegorical sculptures, in which the figures represent ideas, such as hope or freedom. All these characteristics became important in later Greek sculpture.

Lysippus was born near Sikionia. He was court sculptor to Alexander the Great, and his portraits so pleased the ruler that Alexander permitted only Lysippus to model his image. The most famous sculptures by Lysippus include statues of the god Zeus and the hero Heracles (Hercules in Latin). He also created a statue of the god Eros and an allegorical statue of Opportunity.

Marjorie S. Venit

See also **Alexander the Great** (picture).

Lyte, Henry Francis (1793-1847), a British clergyman, is best remembered for the hymns he wrote. They include "Abide with Me" and "Jesus, I My Cross Have Taken." For 25 years, Lyte served as clergyman in the small fishing village of Lower Brixham on the Devonshire coast. In this village, he developed a Sunday school of 800 students and trained more than 70 teachers. Lyte worked constantly, preaching and visiting the members of his parish. He is said to have written "hymns for his little ones, hymns for fishermen, and hymns for sufferers."

Lyte was born in Ednam, Scotland, near Kelso, on June 1, 1793. He was ordained as a minister in the Anglican Church when he was 21 years old. He died on Nov. 20, 1847. Leonard W. Van Camp

Lytton, Baron. See **Bulwer-Lytton, Edward George Earle Lytton.**



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